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No. 2
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NEW YORK BUFFALO HAMILTON, ONT.

DECEMBER, 1949

RAILWAY MECHANICAL ENGINEER

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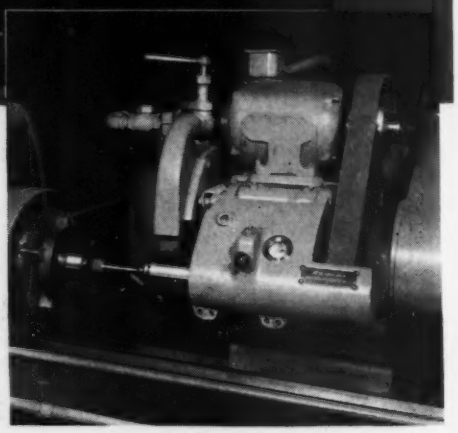
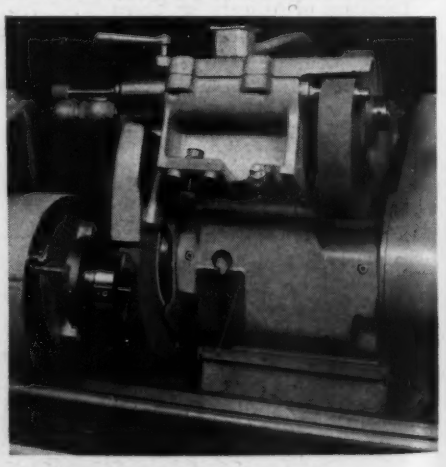


Above and below: Illustrating the use of the internal grinding head and chuck. In this particular instance, external and internal diameters are absolutely concentric; both are ground without removing the part from the chuck.



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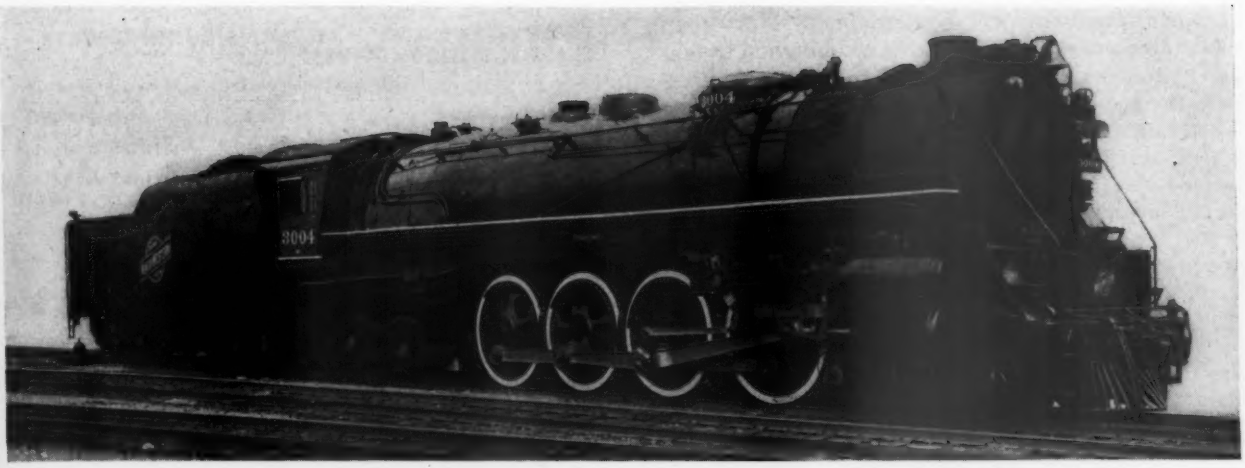
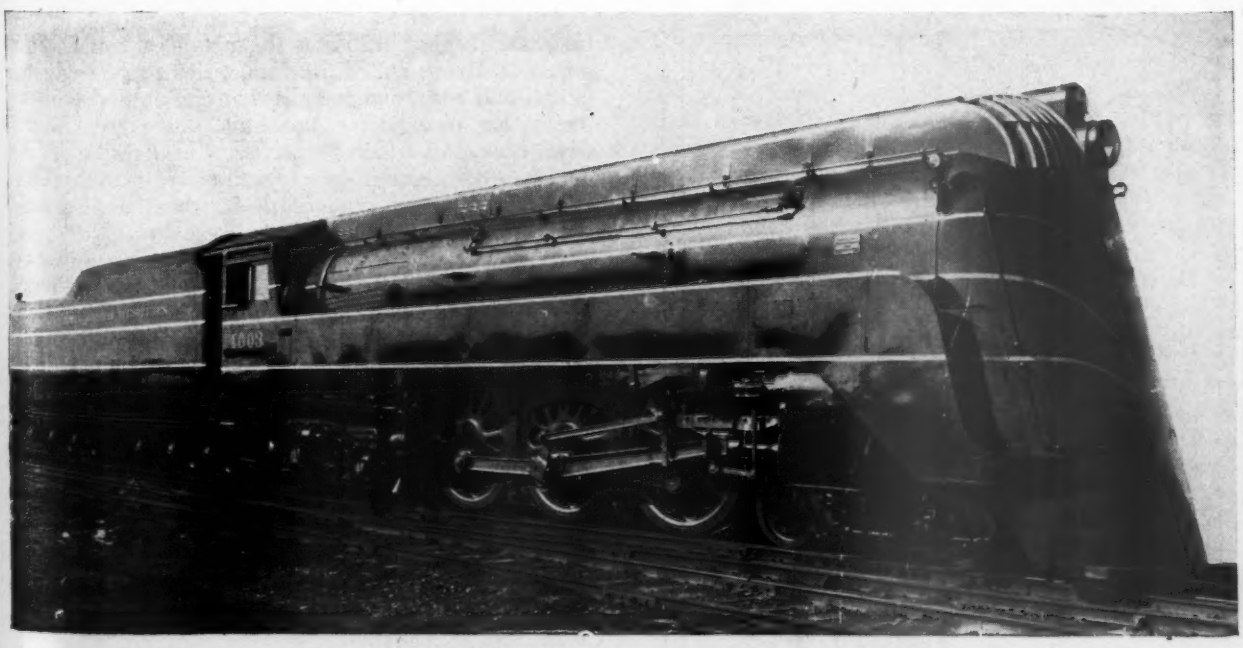


Cost of Modernizing Locomotives Repaid in 3 Years

C. & N. W. 4-8-4's go 400,000 miles between Class 3's—Availability is 90 per cent, repairs 20 cents per mile



The completely modernized Class H-1 locomotives (top) have an average availability of 89.2 per cent and a maintenance cost of 19.8 cents per mile—The use of a transit for laying out the frame and running gear has been a major factor in obtaining an average of over 96,000 miles between Lidgerwooding of tires on the 4003 (below)

THE Chicago & North Western began in 1946 to modernize a group of heavy 4-8-4 combination freight and passenger locomotives* and to improve the repair practices employed during the shopping of the 4-8-4's and other modern classes of power, principally by the use of a transit for layout. The result has been locomotives that go 400,000 miles between Class 3 repairs, and neither receive nor require Class 5's between the Class 3's. The availability of the 4-8-4's averages about 90 per cent, and the cumulative maintenance cost of the 23 modernized to date has averaged 19.8 cents per mile. The saving in maintenance cost alone has repaid the cost of modernization in less than three years. Over and above the saving in maintenance, the railroad obtained a substantial increase in capacity and availability, and a marked reduction in fuel consumption.

The second class of locomotive to which important design and shopping procedure changes were made was the Class E-4 heavy 4-6-4 passenger locomotives. Six of the nine in the group received new welded boilers, all were converted to oil burners, and a procedure was instituted for laying out the frame and running gear with a transit. Individual locomotives in this group have averaged over 96,000 miles between Lidgerwooding of tires.

* For a description of the modernization, see *Railway Mechanical Engineer*, June, 1946, page 295.

TABLE I—CYLINDER AND VALVE BUSHING WEAR—CLASS H-1 LOCOMOTIVES

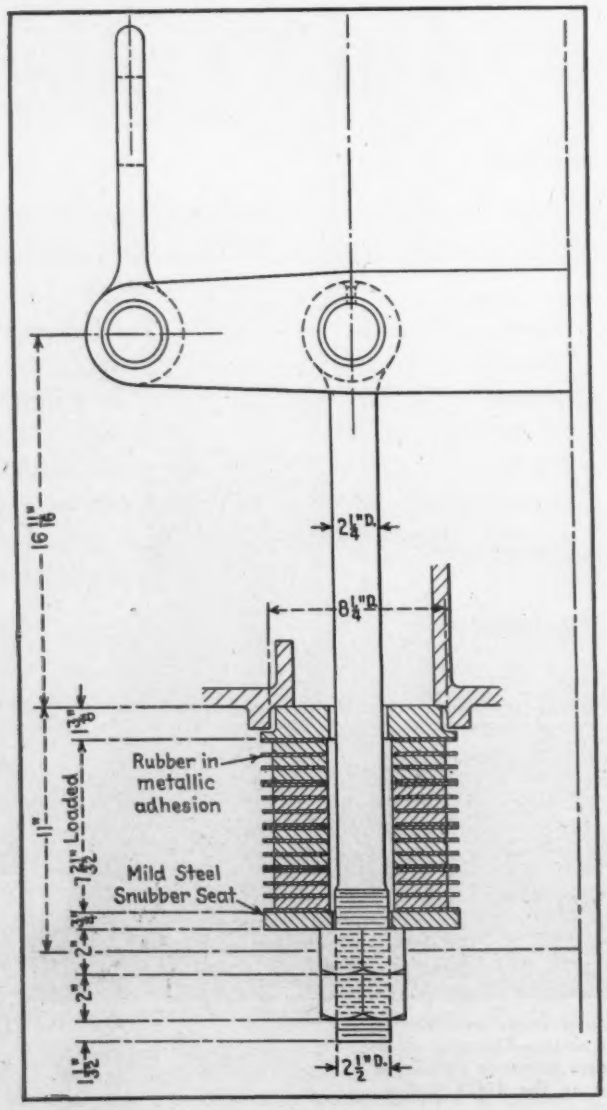
Locomotive	Annual	Cylinder Bushings, In.		Valve Bushing, In.	
		Right	Left	Right	Left
3004	2nd	27.079	27.036	14.177	14.135
		27.040	27.014	14.185	14.144
3032	2nd	27.020	27.052	14.130	14.008
		27.023	27.076	14.131	14.017
3009	1st	27.082	27.053	14.016	14.016
3005	1st	27.032	27.022	14.015	14.025
3013*	1st	26.985	27.000	14.001	13.997
		27.026	27.046	14.016	14.045

* Worst found—bushings pitted, evidence of overtreated water.

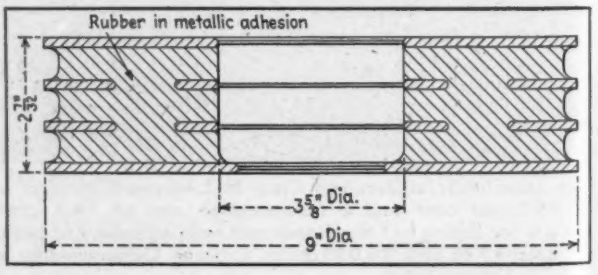
The 4-8-4's were part of a group of 35 Class H locomotives built by Baldwin in 1929. As modernized, they are designated Class H-1, and carry 275 lb. boiler pressure, have a total weight on drivers of 288,000 lb., develop 84,200 lb. tractive force, including booster, have 76-in. drivers and cylinders 27 in. by 32 in. The E-4 Class was built by Alco in 1938 with 84-in. drivers, 300 lb. boiler pressure, 55,000 lb. tractive force, 216,000 lb. on drivers, and cylinders 25 in. by 29 in.

Among the principal changes made during modernization of the H's were new cast-steel beds, enlargement and streamlining of steam and exhaust ports, roller bearings on all axles, light-weight reciprocating parts, larger boiler tubes, flues and superheater units, the application of two new Thermic syphons in the firebox and two in the combustion chamber, an all-welded firebox and tuyere-type grates. The beneficial effect of the modernization plus careful maintenance, including the use of a transit for precision laying out of the frame, shoes and wedges, guides and rods, and for aligning engine and trailer trucks, has resulted in some outstanding records of wear, typical of which is the following data on locomotive 3004, which has completed over 300,000 miles of service and has undergone its third annual inspection:

1. The valve and cylinder bushings were in excellent condition. It was not necessary to bore either the valve or cylinder bushings during the three years of service. The cylinders still used 27-in. diameter packing. Evidence to date is that



Details of the rubber snubber arrangement used in the front spring rigging hanger on Class E-4 4-6-4's



these bushings will go the entire term of service of the 3004.

2. The same shoes and wedges were still on the 3004 that were placed there in April, 1946, when the locomotive was modernized. These shoes and wedges have made 300,000 miles. By using oversize floating plates at the No. 2 and No. 3 drivers the shoes and wedges give evidence of going the full term of service.

3. The crank pins at the Nos. 2, 3 and 4 wheels are three years old and have run 300,000 miles. Sufficient stock remains on them to bring them into quarter and run for at least another year. The crank pins are put in 1/16 in. oversize, and are allowed to wear to ¼ in. undersize. A good grade of regular 0.4 per cent carbon steel is used in the crank pins. The tentative mileage for renewal due to fatigue limits is 350,000. However it is expected that all pins will last to the 400,000 mile term-of-service limit.

4. Locomotive 3004 was equipped with bronze-lined steel valve guides. These guides were in good condition and are suitable for another year of service. The main multiple-bearing guides have a total penetration, or bearing height, of 4¾ in. on each side for lateral stability. The crossheads are made of cast manganese-vanadium steel with a tensile strength of 90,000 to 100,000 lb. per sq. in.

5. The Hulson tuyere-type grates will need very little attention for at least another year. A few tuyere elements only have been replaced on some locomotives.

From the examination of the machinery, the railroad considered that it was becoming more clearly evident that the limiting condition for a "term of service" for the 3004 would be the tube-and-flue-removal period. The machinery held up well enough to last as long as the tubes and flues. If a tube and flue time extension appears advisable, the machinery might well last a full five years or 450,000 miles.

General Wear Data

None of the lip-type cylinder packing has required replacement on the 23 H-1's converted to date, including the 3004 which has made 300,000 miles, the maximum for any of the modernized locomotives. The wear on the 3004 packing was 5/32 in. on the right side and 3/16 in. on the left side; 7/16 in. is allowed. A few segments only have been replaced in some of the locomotives. To date no H-1's have required 27⅛-in. packing, the next step size. The piston-rod and valve-rod packing is renewed annually as a matter of course. No trouble has been experienced with blow-by.

No valve or cylinder bushings have required reboring, even on the 3004 after three years and 300,000 miles of service. On the 3004, the cylinder bushings had opened up about 1/32 in. and the valve bushings about 3/16 in. The latter were not out-of-round sufficient to cause any difficulty. Other tpical examples of cylinder and valve bushing wear on H-1's at different annuals are shown in Table I.

The crossheads and guides on both the H-1's and the E-4's generally go from one annual to another before requiring any attention. Thus, re-babbitting of the guides is required only at 120,000 or more miles on the E-4's and at about 90,000 miles on the H-1's. When crossheads require re-babbitting, the job is done in a mandrel which casts the crosshead babbitt lining directly to a fit of .006 to .010 in. in the guide. No machining is required. Dowels are used to position the crosshead accurately. The re-babbitting can be done during the quarterly when the locomotive is to be out of service 24 to 30 hours.

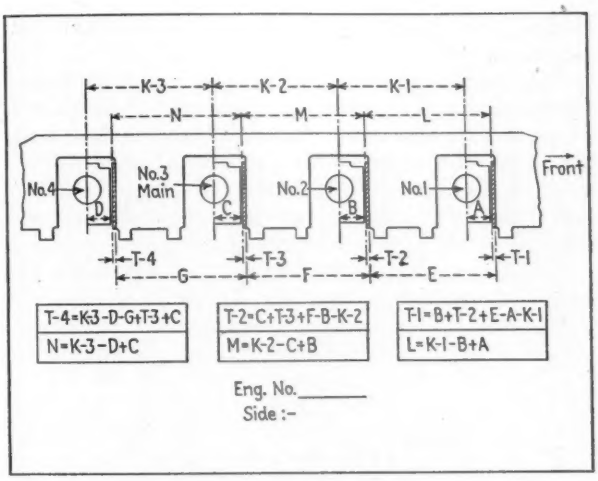
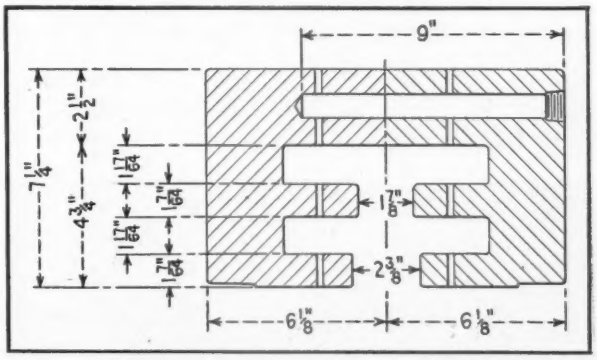


Chart for determining shoe thicknesses and rod lengths when laying out locomotives with a transit



The guide bars on the H-1's have a total penetration of 4¾ in. for lateral stability

To date the only crank pin that has required renewal on the 23 H-1's is the left front pin on the 3004. At the third annual inspection of the 3004, sufficient stock remained on the crank pins to bring them into quarter to run at least another year. A quartering circle is inscribed on the wheel hubs when the crank pins are first turned or ground, and the circle is used as a guide for future turning operations. Rod bushings are renewed at annual inspections, and to date no H-1's have been tied up for bushing troubles.

The floating plates on the No. 1 and No. 4 drivers of the 3004 did not require any attention after 300,000 miles. There was about 1/32 in. wear on the the Nos. 2 and 3 floating plates. These were replaced with ⅛ in. oversize plates so that the original shoes and wedges could be used again. No work was required on any of the shoes and wedges; all were used again without any attention. The maximum rise of the

wedges was about 1½ in. None stuck in service at any time.

The link-block slots on the H-1's are of flame-hardened S.A.E. 1045 steel, which has eliminated all troubes with this part. No link-block bodies have yet required renewal. There was less than 1/64 in. wear on the slot of the 3004 after two years of service. The link trunnions are force-feed oil lubricated and showed no signs of wear after three years.

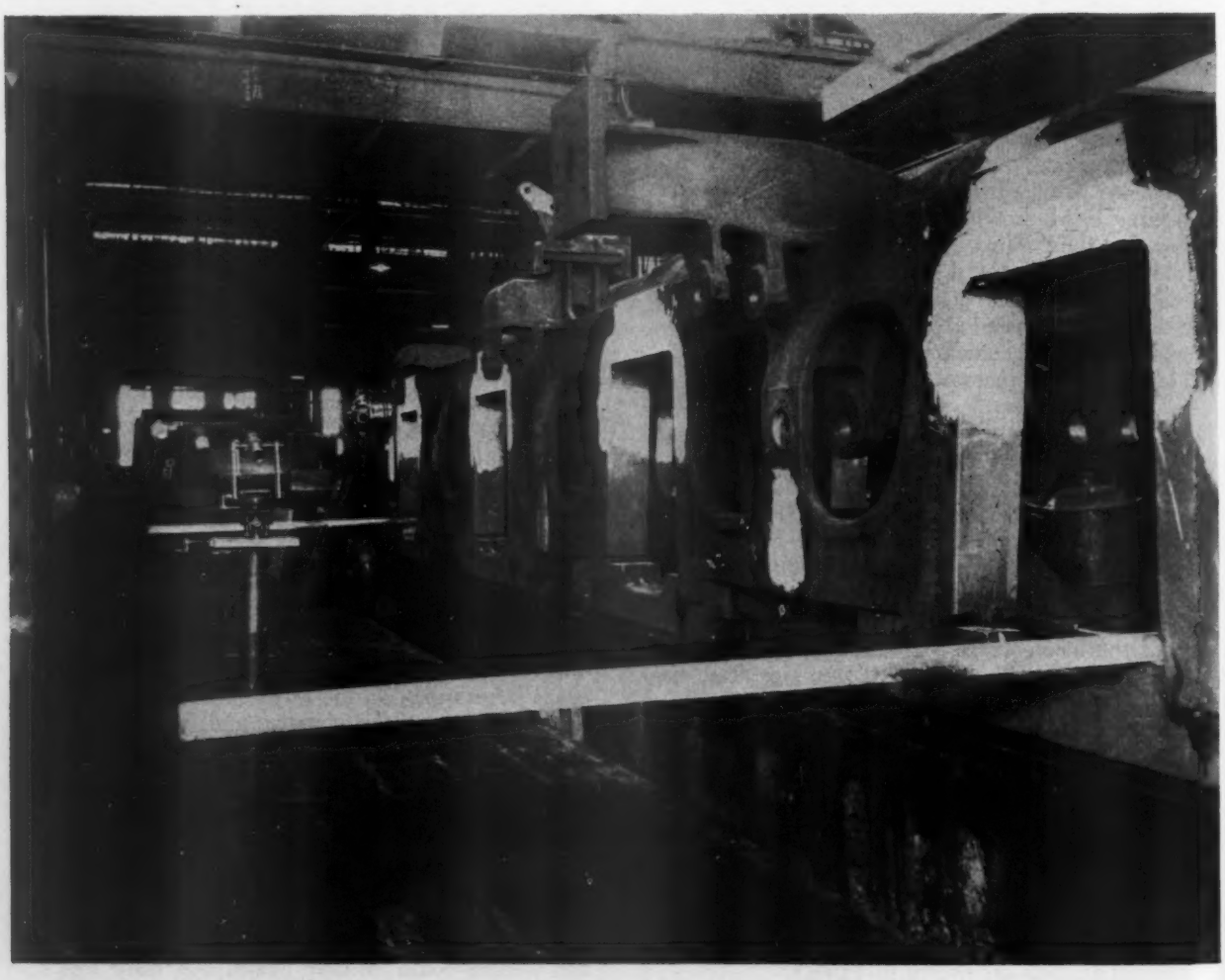
The Baker valve gears on eight of the E-4's are equipped with needle bearings. The 4009 has had experimental Pilliod floating bushings that have been in service about 250,000 miles without showing wear.

A number of test runs were made with the 4-8-4's in both passenger and freight service to determine the fuel consumption. On one test the 3005 handled 4,207 tons between Chicago and Clinton, Iowa, a run of 130 miles, with 29,290 lb. of coal, or a fuel consumption of 53.6 lb. per 1,000 gross ton-miles. The coal used had a heat value of 11,086 B.t.u. per lb. With lighter trains varying from 2,100 to 2,760 tons, the fuel consumption ranged from 66.4 to 74.8 lb. per 1,000 gross ton-miles. The time required to make this run varied from 2 hr. 55 min. to 3 hr. 42 min. In passenger service, the 3005 handled 16 cars (1,230 tons) from Chicago to Omaha with 19 scheduled stops on 68,950 lb. of coal. This was at the rate of 8.8 lb. per passenger car mile for the 488-mile run.

Comparative tests between original Class H locomotive No. 3001 and rebuilt Class H-1 No. 3004 shows an increase in pounds of water evaporated per pound of coal of 25½ per cent. The probable boiler efficiency increased from 56 to 62 per cent. Coal consumption per 1,000 gross ton-miles decreased by one-fourth from 102.4 to 76.3 lb. per 1,000 gross ton-miles. Details of the comparison are shown in Table II.

Several changes made in the boiler and the front end contributed to the increase in efficiency. The 29 2-in. tubes were replaced by 2¼-in. tubes. The 3½-in. flues were replaced by 4-in. flues. An annular ported nozzle was applied, and the smoke-box table plate was raised 22 in. so that the area under the table plate was 162 per cent of the net gas area through the tubes and flues. Stacks with a 27-in. top diameter and a 20½-in. choke were substituted for those with a 24-in. top diameter and a 19-in. choke. These changes have made it possible to move more gas with less effort.

Three minor changes were made to the H-1's to simplify maintenance. To prevent cinder cutting in the top three rows of flues, 2-in. lengths of 3-in. tub-



The use of a transit for laying out the frame and running gear has been a major factor in obtaining an average of over 96,000 miles between Lidgerwooding of tires on the 4003

TABLE II—COMPARISON OF OPERATING EFFICIENCIES BETWEEN ORIGINAL AND MODERNIZED CLASS H 4-8-4's

	Class H 3001	Class H-1 3004
Evaporation, lb. water per lb. coal	6.31	7.91
Probable boiler efficiency, per cent	56	62
Average flue-gas temperature, deg.	410	470
Average superheat temperature, deg.	630	660
Coal, lb. per 1,000 g.t.m.	102.4	76.3

TABLE III—LIDGERWOOD INTERVALS, EXCLUDING FLAT SPOTS, WHERE REASON WAS UNKNOWN, AND THE INTERVAL BETWEEN THE FINAL LIDGERWOODING AND REPLACEMENT BY NEW TIRES

Class	Miles
H	25,991
H (laid out with transit)	34,144
H-1	52,203
E-4 excluding 4006 and 4007	73,759
E-4 including 4006 and 4007	59,168
Individual Locomotives:	
3004	115,000
4003	96,581

ing were welded in front of the return bend of the superheater units. This was tried out experimentally on the 3010, and proved quite successful. It is expected to give the flues a life of five years. Syphon necks are opened at each annual inspection period by cutting, and then rewelded. The opening up and rewelding relieves the thermal stresses that have been built up within the syphon, and eliminates the tendency for the syphon to pull away from the throat.

The third change that has improved availability and reduced maintenance is the use of silico-manganese coil springs at the front of the front drivers and the rear of the rear trailer wheels in the spring equalizing system on the H-1's. On the E-4's, natural rubber snubbers are used at these locations. In both cases, the substitute was for A.A.R. Class G springs. Before the application of the silico-manganese springs and the rubber snubbers, the equalizer springs lasted about 30 days and required six hours to change. Both the silico-manganese springs and the rubber snubbers last from 18 to 24 months. The silico-manganese springs on the H-1's have a travel of 3½ in. with a normal deflection of 1¾ in., and therefore have a margin of 1¾ in. before going solid. The snubbers on the E-4's are of 40-durometer natural rubber.

Results of Transit Layout

The transit method employed in laying out the frame, shoes and wedges, guides and rods, and for aligning the engine and trailer trucks has improved the mileage between Lidgerwooding on the H-1's as shown in Table III. Mileages are also given for the E-4's, although data before the transit method was employed is not available.

As can be noted from the table, the mileage average between Lidgerwooding on the original H class was 25,991. On two of the H's, the 3012 and the 3017, the transit method was also employed and this mileage was raised to 34,144, an increase of one-third. On the H-1's, where both the transit was used and the modernization given, this mileage was increased to 52,203, or a little more than double the mileage on the locomotives as originally built and laid out by conventional methods. Individual H-1's have attained mileages as high as 115,000 while individual E-4's have attained as high as 96,581 miles. It is expected that the average mileage for the Class H-1 engines will increase beyond 52,203 as a number of recently shopped H-1 engines are still rolling up mileage to their first Lidgerwood and hence could not enter the picture as to average miles.

The following steps are involved in using a transit for checking the alignment of locomotive frames, getting a square line and the required thickness of the main shoes, and a proof line for alignment of the guides. The total job requires about two hours:—

1.—The locomotive frame is levelled. This is done with a precise hand level laid on the finished surface on the top of each frame pedestal opening. Jacks are used at the outer ends of the pilot beam and just behind the rear drivers to adjust the frame. The cradle of the locomotive is allowed to hang free.

2.—Plumb bobs are dropped from the center of the engine truck center pin, from the center of the trailer radius bar pin hole, from the center of the drawbar pin hole, and over the center of the chafing iron. The transit is placed in the pit, and the alignment of the plumb bobs checked. If these points do not lie in the same line, the drawbar pin hole and the engine truck center pin govern. If realignment is necessary, the trailer truck radius bar fulcrum is altered to align it with the engine truck pin and the drawbar pin. The center line of the buffer is then checked for alignment with the center line between the engine truck and trailer truck. A mark is put on the rear end of the extension frame in any convenient location so that measurements can be taken from the locomotive center line to the trailer rocker seats.

3.—One piece of 2-in. pipe about 14 ft. long is securely clamped against the shoe face of the front jaws, and a second against the wedge face of the back jaws. Both pipes should extend at least 7 ft. beyond the outer side of the frame on one side and should be adjusted to be perfectly level. They are whitened in the vicinity of the center line of the frame and at their outer ends for marking. The center line of the frame previously established by the plumb bob lines and the line of sight of the transit is then transferred to both the front and rear pipes. Tramming outwards from the center marks establishes a line exterior to the locomotive that is parallel to the center of the frame. If there are any frame castings to obstruct the view, a plumb bob is dropped from the centers on both pieces of pipe. In transferring the center line to the outside of the locomotive, the tram is set for a distance exactly equal to one-half of the cylinder center-to-center distance. In this way, the new line also serves to align the cylinders and guides later in the procedure by establishing the center line for these members.

4.—With the transit in the pit and centered on the center line of the locomotive a series of readings is made with a machinist's scale in a combination square held on the inner surface of the pedestal openings. This series of readings will de-

termine just how far on either side of the center line of the locomotive the pedestal inner edges are located and how thick the inner cars of the frame shoes must be. In the case of roller-bearing power these lateral measurements are most critical.

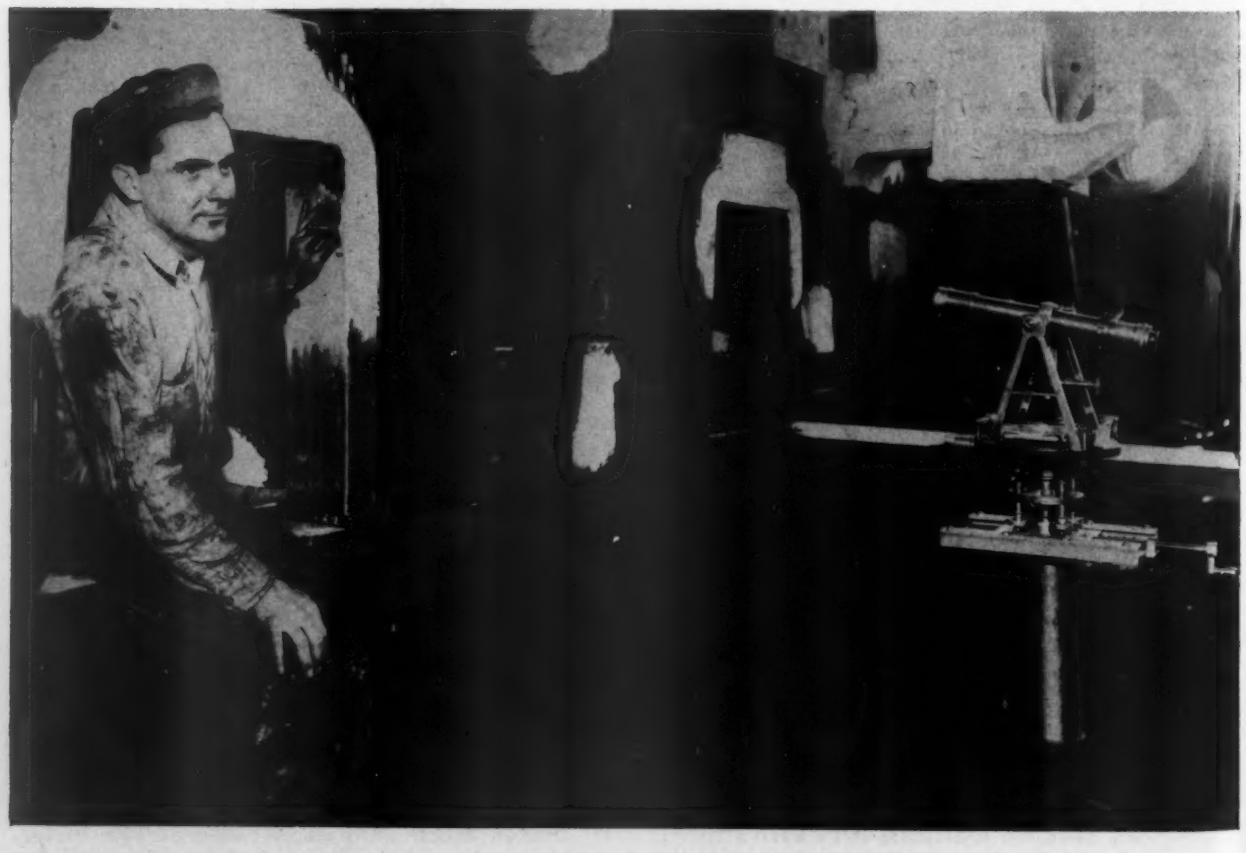
5.—The transit is removed from the pit and leveled alongside the frame about three inches back of the main jaw. It is adjusted so that the line of sight will track on the line parallel to the frame center line as located on the two pieces of pipe. When these two marks are picked up, the transit is turned 90 deg. and a line drawn over the main jaw which establishes a permanent square line on this side of the frame. This line is scribed by dropping an 18-in. scale down the jaw so that the transit vertical crosshair will track up and down the front edge of the scale. When this is done, the line is scribed; then, without moving the instrument, the same procedure is followed to locate the square line on the opposite side of the frame. To check the square line on the instrument, the transit is turned back 90 degrees, and the line of sight should fall on the original line on the pipe. Before the instrument is changed, it is again turned back 90 degrees to the main jaw, and depth micrometer readings are taken to get the thickness of the main shoes. The readings are taken by a depth micrometer on which a line turned on the thimble is adjusted to coincide with the vertical crosshair in the transit.

To lay out proof center lines on the guide ledges for aligning multiple wear guides, the following procedure is employed:

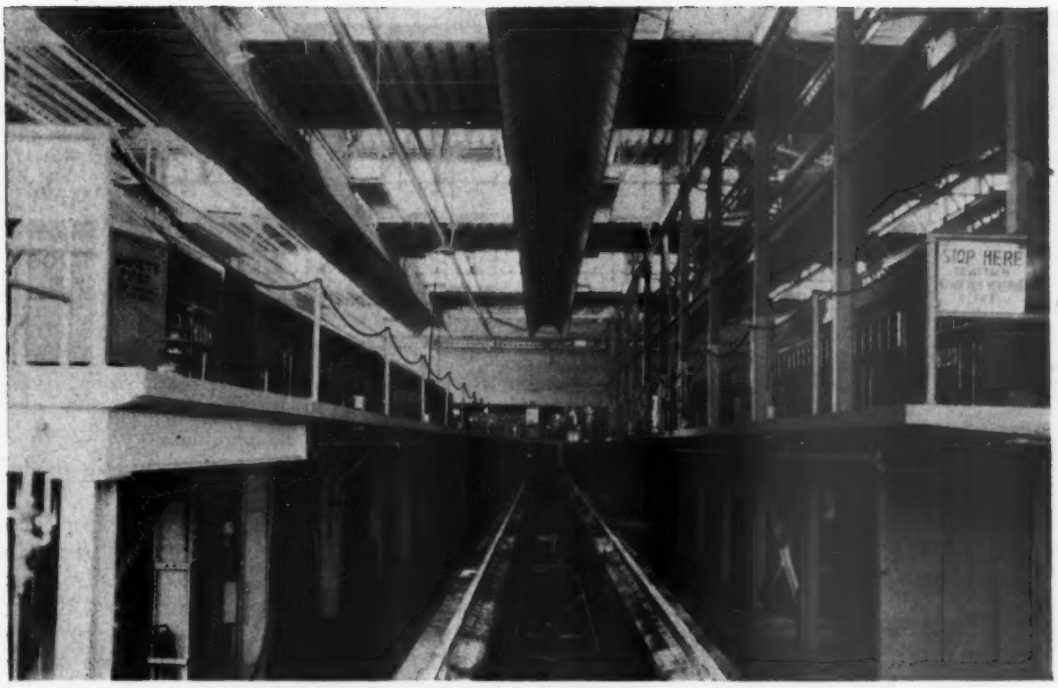
1.—A center is placed in the front end of the cylinder bore, and the center of the bore in the front end determined. The blue print dimension from the center line of the frame to the center line of the cylinder has previously been scribed on the pipes extending beyond the frame. The transit is placed back of the main jaw so that it will pick up the mark on the front pipe and the cylinder center. The transit is leveled to pick up the horizontal centerline of the cylinder.

2.—When these marks are in the line of sight, a scale reading is taken on the stuffing box hole to ascertain if the cylinders are in line and parallel to the frame. If the cylinders are not in line with the frame, a line is drawn up the front and back on the guide ledge, which is prick-punch marked for a permanent guide center. This line is used to determine the correction necessary when reboring the cylinders. The instrument is brought back to the center line of the cylinders, and a scale is dropped from the guide ledge. Readings are taken from the instrument on four points on the guide ledge, from which the thickness of the guide liner to be used is determined.

3.—The layout job is completed by laying off the cylinder striking distance, or main-rod length, to determine the center of the main box. Other rod lengths are determined by tramming front and back from the front face of the main jaw.



The transit permits the thickness of the shoes and wedges to be determined accurately with a micrometer



Inspection pit, depressed floor between pits, elevated work platforms and overhead ventilators in Taylor Yard Diesel shop

Changing Over From Steam to Diesel Power*

An appraisal of the effect on shop facilities and the requirements for efficient maintenance

By F. E. Russell†

THE change from steam to Diesel-electric motive power, now taking place throughout the country, is having a far-reaching effect on maintenance facilities. The two types of power are substantially different insofar as inspection and maintenance requirements are concerned, and it is necessary that extensive changes in facilities be made. Some of the existing steam locomotive facilities will be abandoned; others will be remodeled; some new installations are required.

During the last ten years the trend in motive power on railroads in the United States has been increasingly toward Diesel to replace steam.

On the Southern Pacific, the first Diesel-electric power was used in 1936. Including those now on order, the Southern Pacific System will have a total of 407 Diesel-electric locomotives (969,850 hp.) in service by June, 1950. At the same time there will still be an estimated 1,600 steam locomotives in service. For the United States as a whole, the latest Interstate Commerce Commission report shows that 38,073 steam locomotives were operated during the

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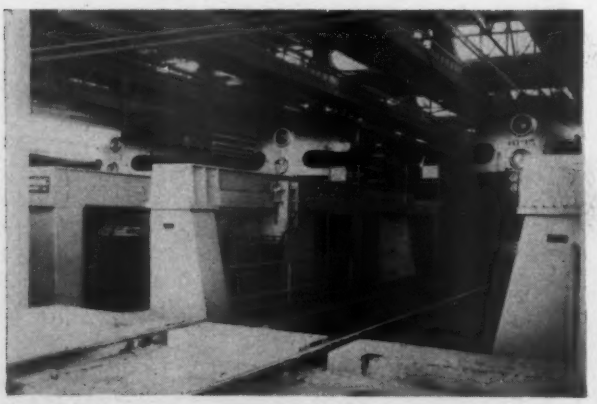
fiscal year ending June 30, 1948. During the same fiscal year there were in service a total of 9,803 locomotives other than steam, of which a large majority were Diesels.

From this it can be seen that, while the number of Diesel-electric locomotives is steadily increasing, steam locomotives still greatly outnumber the Diesels and will for the next few years. It is, therefore, necessary for the railroads to have maintenance facilities for both types of power.

Types of Facilities Required

In some cases, as for instance when the Diesels are switchers and road switchers, the same repair facilities can be used for steam and Diesel, although some additions and modifications are necessary to make them suitable for Diesel maintenance. Existing roundhouses and inspection pits are satisfactory, but some special tools for working on Diesel engines and electrical equipment are required. Fueling, engine-cooling-water and sanding facilities must be installed. For heavy repairs, existing shops where pits and necessary lifting equipment are available can be used.

For Diesel-electric road locomotives, new or completely remodeled facilities are required for routine maintenance and running repairs. It is imperative that these facilities be so located and constructed that a minimum of time will be required for maintenance. The initial cost of Diesel-electric power is considerably higher than that of steam, and to offset this higher first cost modern facilities which will make possible maximum availability and efficient utilization must be provided. Existing steam locomotive facilities are not suitable. Heavy repairs to these locomotives can be handled in existing steam repair shops. However, it is necessary that work platforms and benches be installed, and in many cases some rearrangement of the shop is desirable. At intermediate points and turn-around or non-maintenance terminals, no extensive changes in facilities are necessary. Requirements at intermediate points are dependent on the length of run, and where necessary, fueling, cooling-water and sanding facilities are installed. In addition, at non-maintenance terminals, facilities must be provided for making inspections required by the Interstate Commerce Commission and for making minor repairs.



Drop pit inside of shop, showing drop-pit tables and locomotive body supports

The shape of most roundhouses, with all tracks converging at the turntable, is such that the required space for efficient inspection and servicing is not available. Multiple-unit Diesel locomotives are so long that if they are taken into a roundhouse over the turntable they will either extend onto the turntable or it will be necessary to separate the units, with consequent loss of time and availability. The multiple-unit Diesel locomotive cannot be turned on the normal turntable due to its length. As an example of the difference between the two types of power, a four-unit Diesel freight locomotive is 201 ft. 6¼ in. long, while the largest steam locomotive on the Southern Pacific has a total length, including tender, of 125 ft. 5 in.

It has been determined from experience that the most suitable type of building for Diesel locomotive maintenance is one which is generally rectangular in shape, with tracks running through it if possible, and having track pits and proper working space around the locomotive. The latter includes a depressed floor level between the pit rails to facilitate truck work and inspection of brake equipment, and an elevated platform at locomotive floor level. Pits must be of sufficient depth, well drained and well lighted.

Other basic requirements for the Diesel locomotive maintenance shop include cranes for lifting material out through the roof of the locomotive, facilities for removing wheels and traction motors or trucks, and supply lines for fuel, lubricating oil and cooling water. Included as part of the shop or located in the immediate vicinity should be a small machine shop, electric repair room, air brake and piping room, filter cleaning room, lubricating oil testing and reclamation facilities and storage, fuel oil storage, sanding and cooling water facilities, a machine for washing locomotive exteriors and battery charging equipment. Some of these facilities, such as the machine shop, electric shop and air brake and piping room, are already in existence at locations where steam locomotives have been maintained. Others must be provided when the Diesel maintenance shop is established. Another important factor in efficient maintenance of Diesel locomotives is proper stores facilities at a convenient location with respect to the service areas. This is necessary in order that worn parts can be removed and new or rebuilt parts applied to the locomotive while in shop with a minimum of delay.

New Diesel Shop at Los Angeles

The first completely-equipped shop on the Southern Pacific lines for maintenance of Diesel-electric road locomotives was built at Taylor Yard in Los Angeles, Calif. Taylor Yard has for many years been a maintenance terminal for steam locomotives, and at the present time both types of power are being handled. Present plans call for the eventual abandonment of the roundhouse and turntable which are required for steam locomotive maintenance.

At Taylor Yard a new building, 351 ft. long by 140 ft. wide, was built. This building contains six maintenance tracks, each having an inspection pit 215 ft. long. The pits slope slightly toward the center for drainage. The floor level between pits is 38 in. below the top of rail. Elevated platforms at locomotive floor level are provided between all tracks and between the tracks and longitudinal walls of the building. Also, since the tracks do not run through the building, the elevated platform level is continuous at the stub end of the tracks. At the same level, space is provided for the stores department, a machine shop equipped for handling small parts and a filter cleaning room. At the depressed floor level, there is a parts storage space and oil reclamation room. Ample electric lighting is provided inside the pits and under the elevated platform. This permits of easy inspection of under side of locomotive from within the pits and of running gear from outside the pits.

Two of the maintenance tracks are served by a drop pit, which is used for changing trucks. The drop pit extends to a track outside the shop leading to the machine shop, where truck repairs are made. Three two-ton overhead traveling cranes are installed to facilitate removal of parts from the locomotives. Above each track is a ventilator running the full length for removal of exhaust gases.

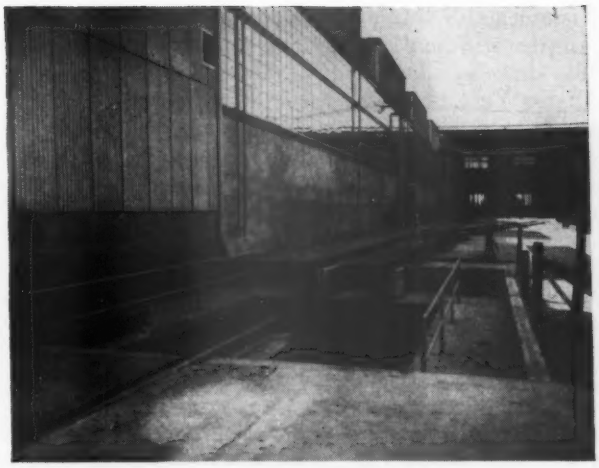
Inside the shop, piping for removal of used lubricating oil and for the addition of lubricating oil and engine cooling water is installed. Outlets for these pipes, as well as for steam and air lines, are provided at convenient locations.

Pumping facilities for lubricating oil and cooling water are installed in the oil reclamation room. Also included in this room, in addition to the oil reclaiming equipment, are storage tanks for used and reclaimed lubricating oil and for cooling water. Underground tanks for new and used lubricating oil are installed near the Diesel shop.

Among the additional equipment to be provided is a Diesel engine-load tester. This is a device for applying an artificial load to the Diesel engine and main generator following repairs, and permits testing under full load conditions before leaving the shop.

On the main inbound track to the Diesel shop, known as the service track, there are an automatic two-brush washing unit, sanding facilities, fuel oil and cooling water outlets and an inspection pit. Sanding is done from two overhead tanks having four flexible outlets so that all sand boxes on one unit of the locomotive can be filled at the same time. Fuel oil outlets are so spaced that all units of the locomotive can be fueled at once. Fuel oil and cooling water storage tanks and pumping facilities are located in the vicinity of the service track. Distilled water for engine cooling is obtained at the present time by collecting the condensate from the heater used for heating steam locomotive fuel oil.

A modern, well equipped control laboratory has been established at Taylor Yard, its primary function being to check lubricating oil and cooling water



Drop pit outside of shop, with truck release track and machine shop in background

for any conditions which might lead to crankcase explosions or serious damage to equipment.

Samples of lubricating oil and cooling water are taken from each engine in a locomotive as soon as the locomotive arrives at the service track. Analyses are made prior to dispatching the locomotive on its next trip, and thus any deficient condition in lubricating oil or cooling water can be remedied before it has a chance to cause damage to equipment.

This type of laboratory control also permits extension of draining periods on lubricating oil, the oil being drained on the basis of laboratory tests instead of arbitrarily on a mileage basis as would otherwise be necessary. When it has been determined from laboratory analysis that the lubricating oil should be changed, it is drained from the crankcase with suction pumps to the underground storage tank. It is then put through the reclamation plant in 90-gal. lots and returned to storage. The reclamation process is followed closely and acceptance or rejection of the reclaimed oil is based on laboratory analysis.

The control laboratory is housed in a newly constructed one story building about 44 ft. long by 24 ft. wide, and is equipped with modern working facilities, including steel work benches and fume hoods. Equipment includes Zeitfuch kinematic viscosimeters for rapid determination of oil viscosity and an Applied Research grating-type emission spectograph for analysis of used lubricating oil samples to determine, in a rapid manner, the possible contaminants such as metals in the lubricating oil which may lead to equipment failures.

At present there are assigned and working out of Los Angeles terminal 40 four-unit 6,000-hp. Diesel freight locomotives, five three-unit 6,000-hp. Diesel passenger locomotives, four 1,500-hp. branch-line Diesel locomotives and 42 Diesel switchers. In the near future five additional 6,000-hp. freight and one 6,000-hp. passenger locomotives will be added to this service. All maintenance work on the road locoomotives is handled progressively on a mileage basis.

The passenger locomotives operate in a pool, making one round trip between Los Angeles and

Tucumcari, N. M., and two round trips between Los Angeles and San Francisco every five days. During this five-day period a locomotive is brought to Taylor Yard three times, two of which are for very short periods when the only work performed is washing, fueling, sanding, check of lubricating oil and cooling water and visual inspection at the service track. The third time is for a period of approximately ten hours, during which, in addition to the items mentioned above, the locomotive is taken into the Diesel shop for required mileage maintenance.

Of the 40 freight locomotives, eight operate on the San Joaquin Division between Los Angeles and Bakersfield, Calif., six operate on the Coast Division between Los Angeles and Watsonville Junction, Calif., and 26 operate east out of Los Angeles to San Antonio, Tex., or intermediate points. These locomotives are taken into the Diesel shop approximately every 2,500 miles for mileage maintenance work. Between the shoppings they are taken to the service track for servicing and visual inspection. For example, locomotives operating on the San Joaquin Division are given a heavy turn in the Diesel shop only after eight round trips and those on the Coast Division after five or six round-trips.

In addition to the mileage maintenance, wheels on all locomotives are checked every 15 days for rim thickness, flange wear and tread wear. When a wheel reaches the limit of wear and requires renewal or turning, the complete truck is placed on the drop table, removed and a replacement truck applied. The removed truck is then taken to the machine shop, where a ten-ton overhead crane is available to facilitate replacement of wheels and traction motors.

A modern 50-in. car-wheel lathe is being installed, in a new building conveniently located adjacent to the Diesel shop, for turning Diesel locomotive wheels. A Magnaflux inspection unit for wheels and axles will be provided in this building.

The machine shop at Taylor Yard is equipped to make repairs to some of the parts removed, such as cylinder heads and liners, pistons and wrist pin bushings and the electric shop repairs relays and reconditions brush holders, voltage regulators, load regulators, etc. Other parts, including injectors, traction motors and main generators, are returned to the manufacturer for repair.

Work on the Diesel maintenance facilities at Taylor Yard was started in April 1947 and is complete with the exception of some minor items. The total cost of the entire facility is $1,123,460, including the laboratory which cost $14,637.

No special facilities have been provided for these locomotives at terminals away from Los Angeles, except for fueling and in some cases for sanding. At these terminals only emergency maintenance work is performed. Fuel is added, lubricating oil and cooling water levels are checked and the locomotive is given a visual inspection.

Proposed Facilities at Ogden and Roseville

Present plans call for a total of 27 four-unit 6,000-hp. Diesel freight locomotives to be placed in service this year to operate between Ogden, Utah, and Sparks, Nev. Also, 22 freight locomotives have been ordered for operation between Roseville, Calif., and Eugene, Ore. Maintenance facilities will be installed at Ogden and Roseville.

At Ogden two 215 ft. outside inspection pits, with fuel and cooling water outlets, are available. Future plans call for a Diesel maintenance shop which consists of a part of the present steam locomotive erecting and machine shop, with a building extension added to give the required length. Inside the shop will be three 215-ft. inspection pits and three servicing platforms. Also included in the future plans are complete lubricating oil facilities.

At Roseville, present steam locomotive facilities include two roundhouses with turntables, one for large locomotives and the other for small locomotives. Because of space limitations a portion of the small roundhouse will be removed and a Diesel maintenance shop, with inspection pits and other features similar to those in the Taylor Yard shop, will be built. When first built, this shop will have only three maintenance tracks, but at a future date when the roundhouse is abandoned the shop will be extended to include additional maintenance tracks. A stores department building will be erected adjacent to the shop and necessary fuel oil, lubricating oil and coolant water storage and piping will be installed. Plans provide for two outside inspection pits with fuel and cooling water outlets and sanding facilities and with washers adjacent to them.

General Shop Facilities at Sacramento

On the Southern Pacific lines, heavy repairs to Diesel engines and parts are handled in the general shops at Sacramento and Los Angeles. In these shops a portion of the steam locomotive erecting shop has been designated as the Diesel repair area and special facilities to expedite the repair work have been provided.

At Sacramento these special facilities include the following:

1. Portable scaffolding, mounted on casters, of proper height for working on engines when they are on the floor.
2. Special piston racks, mounted on casters, which hold eight pistons each.
3. Wooden benches, the tops of which are covered with linoleum to prevent damage to parts, for working on various sub-assemblies.
4. Universal positioners, equipped with adapters to accommodate all types of cylinder heads, which can be revolved and held in any position for the various operations.
5. Large cleaning tank for removal of carbon from heads, connecting rods, etc., and small tanks for aluminum pistons and other parts.
6. Portable wooden step sets for convenient entrance to doorways of the locomotives.
7. A 10,000-gal. storage tank for treated cooling water and pump for delivery of the water to the locomotive.
8. Booster pump for lubricating oil, providing

forced circulation of the oil throughout the entire lubricating system.

9. Exhaust pipe on the test run pit for removal of gases from the shop.

10. Water rheostat for testing the output of generators and engines.

The only time a road locomotive is brought into the shop is when heavy repairs to an engine, such as replacement of an engine frame or crankshaft, are necessary. Only the unit having the engine to be repaired is shopped, the engine is removed and a replacement engine is installed. The removed engine is then completely disassembled and overhauled.

Reconditioning of Diesel switcher parts, such as cylinder head assemblies, cylinder liners, pistons and connecting rod assemblies, is also done at Sacramento general shops. When a locomotive is shopped at a division roundhouse the worn parts are removed and sent to Sacramento and overhauled parts already on hand are installed. The worn parts are reconditioned at Sacramento and then placed in stores stock for shipment where next required. Switchers are shopped at Sacramento when it is necessary to change the engine or make other repairs requiring heavy lifting equipment.

A change that will probably take place in a few years in Southern Pacific shops is in the amount of manufacturing. Various parts for steam locomotives, including forgings and brass and iron castings, are made at the general shops. Many of these parts are carried in stock in semi-finished form and finished as necessary when applied to the locomotive. Parts for Diesel engines, on the other hand, are precision made by the engine builder and interchangeable so they can be immediately applied to any engine of a given type. Because of the special machine tools and other equipment that would be required it is unlikely that railroads will manufacture Diesel parts in any volume. This will have an unpredictable effect on personnel as well as machinery requirements at the shops.

Facilities at Outlying Points

As additional Diesel locomotives are placed in service and steam locomotives are retired, extensive changes in requirements for maintenance facilities at outlying points will take place. Studies have been made which indicate that at some points present steam facilities, including roundhouse and turntable, can be abandoned completely. At all points, heavy fuel and water facilities now required for steam locomotives will be abandoned. At many of these terminals turntables will be retained for turning Diesel switchers, road switchers and single-unit road locomotives. Diesel fueling, cooling water and sanding facilities will be installed. Other changes at these locations will include in some cases abandonment of such facilities as machine shop, boiler shop and power plant.

Conclusion

In summarizing the foregoing discussion of motive power maintenance facility requirements, it is evident that extensive changes must be made in the next few years as the railroads change from steam to Diesel locomotives. A considerable expenditure of money is involved in providing these facilities, but they will pay for themselves in a short time by making possible efficient servicing and greater availability of the power. Quality of workmanship and morale of maintenance personnel is improved by the establishment of modern facilities where shops and locomotives can be kept clean and orderly. The required facilities are in all cases a joint undertaking of the operating, mechanical, engineering and stores departments, and close cooperation between these departments is necessary in planning the size and type of facilities to be provided at various locations.

Service track at Taylor yard, showing inspection pit, sand tanks outlets, washer and fuel and cooling-water outlets

D. L. & W. Passenger Cars

NINE sleeping cars, each with six double bedrooms and ten roomettes, and fifteen 62-passenger coaches have been delivered by the American Car and Foundry Company to the Delaware, Lackawanna and Western. The coaches are used between New York and Buffalo while the sleeping cars operate between New York and Binghamton, Elmira, Buffalo and Chicago.

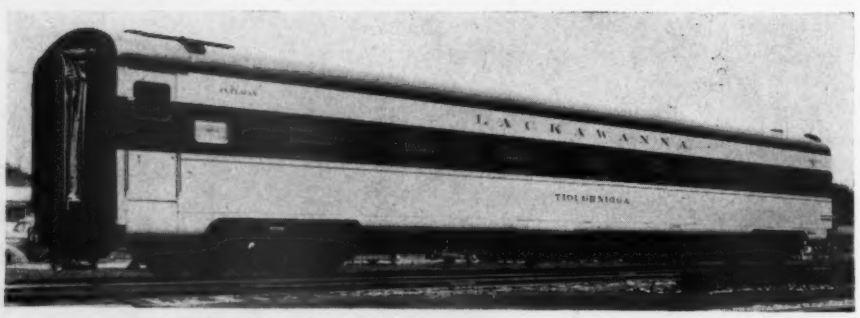
In keeping with the Lackawanna's standard color scheme, the cars are gray with a band of maroon through the window panels. A yellow stripe separates the two principal colors, with another stripe four inches from the bottom of the sides.

The framing design is for lightweight streamline trains with basic materials of low-alloy high-tensile steel. The cars are 85 ft. long over coupler pulling faces, 10 ft. wide, 13 ft. 6 in. from rail to the top of the roof, while truck centers are 59 ft. 6 in. apart.

The underframes are built around 31.3-lb. Z-26 section center sills, with side sills of 8.2-lb. Z-7 sections extending from end sill to end sill. The bottom cover plate extends from the rear of the draft lugs to three feet beyond the bolsters which are built-up ¼-in. web low-alloy high-tensile steel. Felt seals between the body and truck center plates keep out dirt. Built-up welded crossbearers and $\frac{3}{32}$-in. pressed channel floor beams comprise the remainder of the major underframe members.

Electricity is provided by an axle-driven generator with Spicer drive. Genemotors of 25 kw. capacity have been furnished by Safety Car Heating & Lighting Company, with a 15 hp. motor on the a.c. end for standby service. With the predominance of fluorescent lighting a General Electric 2.2 kv.-amp. booster inverter has been installed to provide three-phase 115 a.c. volt power. Kathanode type Gould batteries are part of the electrical equipment, eight double cell monobloc trays per car.

Above: Porter's section in one of the six double-bedroom, ten-roomette cars shown at right



One of the 62-passenger coaches

Luminator lighting fixtures are used in the sleeping cars and in passageways and vestibules of the coaches. Adams and Westlake baggage rack fixtures and Safety center ceiling fixtures light the main section in the latter while other incidental fixtures are of Pyle-National and Electric Service Manufacturing design.

Westinghouse high speed passenger braking equipment has been installed, with provision for the later use of electro-pneumatic straight air control. A. A. R. tight-lock passenger type couplers, arranged for double rotary operation, are used in conjunction with Waugh Twin-Cushion draft gears. Trucks are four-wheeled, with single drop type equalizers and Hyatt roller bearings.

Insulmat, 1/8-in. thick, forms the basis for insulation. Ultralite is then applied throughout, the outside sections receiving three inches, the car ends two inches, and other insulated surfaces such as water tanks, pipes and air ducts receiving one inch.

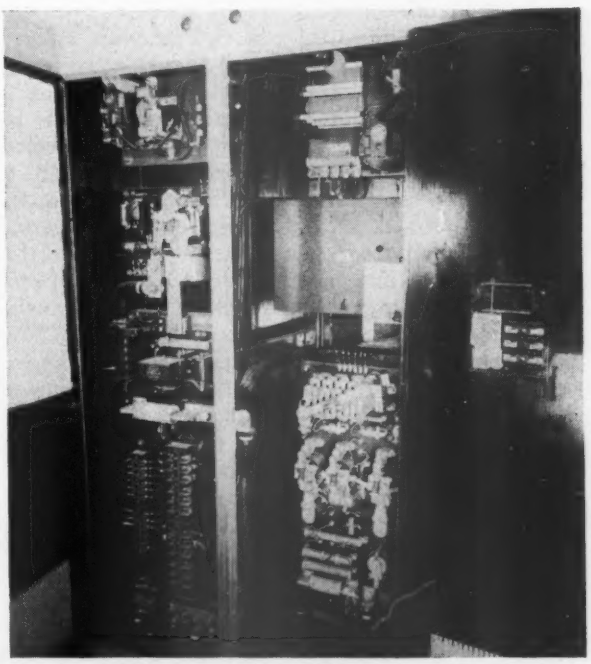
The provision for smoking throughout all cars has required a careful calculation of air-conditioning and heating needs. Vapor thermostatically controlled heating and Safety electro-mechanical air-conditioning of eight tons capacity provide all-weather control. About 25 per cent fresh air is circulated, the balance being re-circulated. Provision has been made for further comfort by the installation of activated carbon filters in coaches and for further application in sleepers should the need arise.

The coach interiors represent deluxe rail travel without too great a sacrifice of revenue space. The seats, a double rotary reclining type manufactured by Heywood-Wakefield, are the latest in coach comfort; from spring-filled backs to individual rubber covered foot rests they have been engineered for comfort.

The coaches have running ice water and the interiors are decorated for eye comfort as well as eye appeal. The lavatory in the women's lounge has a mirror as do the two vanity tables set one on each side of the entrance way with a double lounge seat completing the facilities. Men have ample space, too, with two double lounge seats in addition to the usual facilities.

The nine sleeping cars have been named after rivers and mountains contiguous to the Lackawanna. The ten roomettes and six double bedrooms have been designed according to postwar practice, the latter having beds which in alternate accommodations are either longitudinal or across the car. Separate accommodations are provided for the porter. Bedrooms may be sold to form bedroom suites, as there are folding partitions between each pair of rooms, providing the equivalent of a drawing room when the demand arises.

Bedrooms and roomettes are equipped with modern sleeping car conveniences, individual control of heating and cooling and complete toilet facilities with those in the bedrooms completely enclosed in a separate annex. The toilet facilities in the bedroom are toward the passageway which enables the installation of 3 ft. 6 in. windows. The longitudinal beds have the additional advantage in that both uppers and lowers can be made up by the porter before starting his run. A folding chair, which can be stored under the lower bed at night, is also provided. Electro-mechanical water coolers are provided in each sleeper with running ice water available in each roomette and bedroom.



Electrical control panel in one of the coaches

One of the trucks under the roomette-bedroom car

Electro-Motive Switchers

THE Electro-Motive Division, General Motors Corporation, on October 25, announced three new Diesel switching locomotives. At an open house for railway officers C. R. Osborn, vice president of General Motors and general manager of Electro-Motive, called attention to many of the new features built into these locomotives as well as the increased service life between major overhauls. For instance, he cited increases in service life from 40,000 to 600,000 miles in piston rings, 50,000 to 1,000,000 miles in pistons, 100,000 to 1,000,000 miles in main and connecting rod bearings, as compared with the first G. M. Diesel engines.

Similarly, he pointed to reductions in the number of anti-friction bearings from 40 to 16 (12 of which are sealed and require lubrication only every 5 years); entire elimination of 34 belts formerly requiring constant adjustment and renewal; replacement of six flexible couplings by four requiring no lubrication.

Typical of development work resulting in increased capacity, Mr. Osborn cited the new Electro-Motive silicone-insulated traction motors, said to give 25 per cent increase in locomotive tonnage rating, 23 per cent more dynamic braking effort and greatly reduced frequency of armature removal for dipping and baking. He mentioned the new injector for burning lower grade fuel and, in connection with the need for still further improvement said, "We are spending more time and money on engine development today than at any time in the history of the company. The only change we make, having reached a million-mile goal, is to set our sights for two million and start all over again."

The new switching locomotive models include a 1,200-hp. yard switcher, an 800-hp. yard switcher and a 1,500-hp. road switcher, transfer, or general-purpose locomotive.

The 1,200-hp. model, superseding the 1,000-hp. model produced since 1938 and delivered at the same price, will be in production before the end of 1949.

The new 800-hp. switchers, designed to do the work of 1,000-hp. units at considerably lower cost, are planned for delivery in the late 1950 summer.

The 1,500-hp. road switcher and transfer locomotive is now in production, along with the E-8 passenger, F-7 freight and FP-7A heavy-duty passenger units.

The new 1,200-hp. 125-ton switcher is powered by the G. M. 567-series 12-cylinder Diesel engine which has a surplus of horsepower not used in previous switcher models. With the use of the new silicone-insulated traction motors and the new generator developed by Electro-Motive, and with a new and higher capacity cooling system, it now is possible to utilize more of the latent horsepower. The engine develops sufficient power to give the switcher a full 1,200 hp. for traction with all auxiliaries in operation.

This locomotive, which is 44 ft. 5 in. long over couplers, has a 22-ft. truck center spacing, 8-ft. truck wheelbase and can negotiate a 100-deg. minimum radius curve, carries 600 gal. of fuel oil, 223 gal. of cooling water, 165 gal. of lubricating oil and 28 in. ft. of sand. At 25 per cent adhesion, it develops approximately 62,000 lb. tractive force at starting, 25,000 lb. at 15 m.p.h., 10,000 lb. at 30 m.p.h. and 5,000 lb. at 50 m.p.h.

New E-M type GP-7 1,500-hp. Diesel road switcher

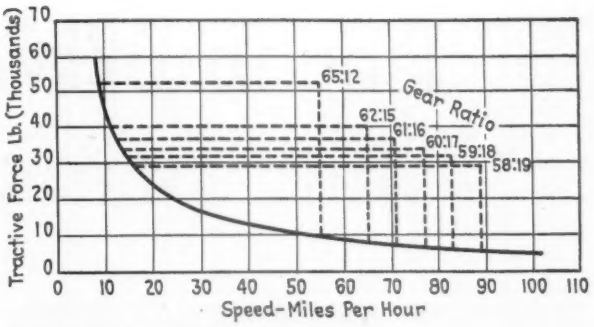
The increased horsepower rating gives greater potential work capacity. Not only is the locomotive capable of moving a given tonnage at higher speed in yard service, but it is adaptable to heavy humping, transfer service, local freight and other of the more rugged and difficult jobs of heavy switching.

Like other G. M. Diesel switchers, the 1,200-hp. model retains the important advantages of high visibility in all directions, low center of gravity, quiet cab, clean exhaust and easy accessibility of parts which may be readily interchanged with those of other types of G. M. locomotives.

The new 800-hp. 115-ton switcher will be powered by the G. M. 567-series 8-cylinder Diesel engine. Delivering ample power to provide a full 800 hp. for traction with all auxiliaries in operation and equipped with the new silicone-insulated, longer-lived Electro-Motive traction motors and new generator, this locomotive is designed to do the work heretofore assigned to Diesel locomotives in the 1,000-hp. class. The locomotive, incorporating all basic advantages of the 1,200-hp. switcher just described, will be delivered at a new low base price for switchers capable of its performance.

The new GP-7 general-purpose 1,500-hp. road switcher is designed especially for use in the Dieselization of secondary line freight and passenger service. This locomotive can switch a yard, go out on either the branch or mainline and haul freight or passenger trains. Its gear ratio options cover a range of requirements from hump switching to 90-mile-an-hour passenger service.

The locomotive is based on the F-7, road-freight locomotive unit, with a special body permitting high visibility for switching. The prime mover is the G. M. 567-series 16-cylinder Diesel engine used in the F-7. Generator, traction motors, cooling fan units, traction motor blowers and all other major components are interchangeable with F-7 road power. All accessories are a.c. motor driven, eliminating V-belts and drive shafts.



Speed-tractive-force curve of GP-7 1,500-hp. Diesel road switcher

Among outstanding developments in the GP-7 are a new and simplified electric control system designed to provide instant response to throttle for ease and speed in switching. A starting tractive effort up to 62,000 lb. at 25 per cent adhesion is under control of the operator. Transition is fully automatic.

Cab location and design is such that the locomotive can be operated in either direction with single control. The cab is equipped with individual temperature control for both engineer and fireman for winter operation and forced air ventilation for summer comfort.

If passenger service falls within the locomotive's assignment, it is equipped with a 2,500-lb. capacity steam generator and carries 800 gal. of heating water.

The two four-wheel trucks employ the Electro-Motive developed outside swing-hanger suspension which gives exceptional stability at high speed and on curves.

Maximum accessibility for servicing and high interchangeability of parts have been provided to make the locomotive especially suited for use in isolated districts and in pools with other G. M. locomotives.

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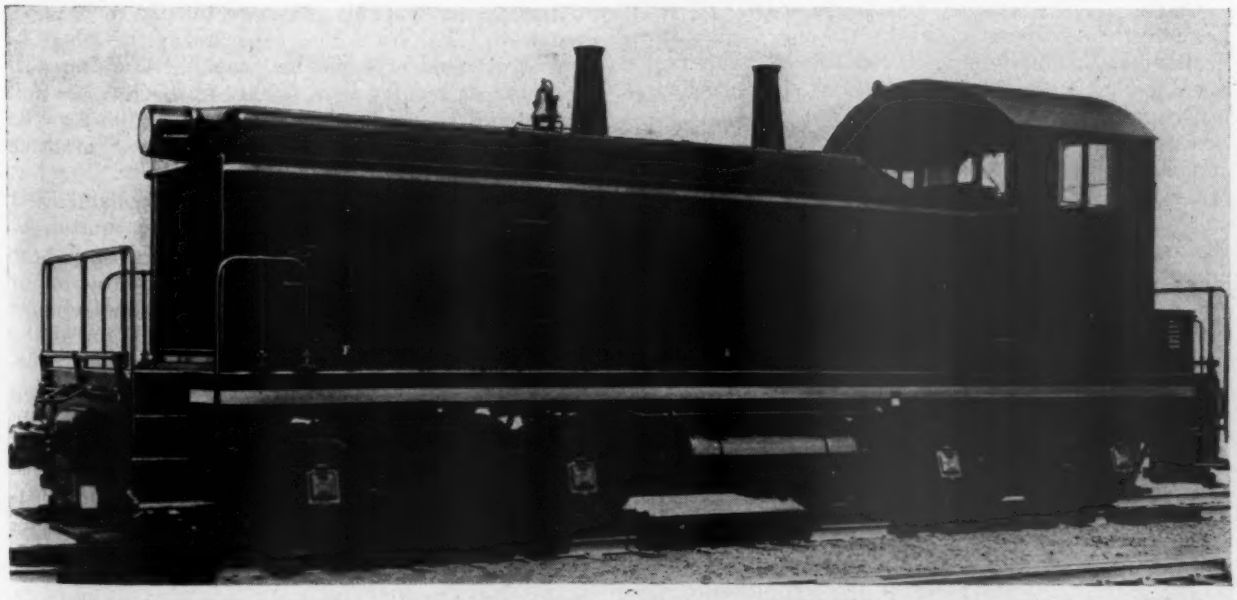


Electro-Motive 1,200-hp. heavy-duty yard-switching locomotive

Locomotive Test Plant For British Railways

*By E. C. Poultney**

Interior of the testing plant building looking towards the control room—The locomotive rollers are shown on either side of the lifting table

THE new locomotive testing station which has been built at Rugby was formally opened by the Minister of Transport on October 22, 1948. The completion of this project, which owes its inception chiefly to the persistent advocacy of the late Sir Nigel Gresley, chief mechanical engineer of the former London & North Eastern Railway, marks an important event in the history of the British railways, being the first of its kind to be constructed.

Originally, the scheme was inaugurated by the London & North Eastern and the London, Midland & Scottish under the direction of Sir Nigel Gresley and Sir William Stanier in his capacity as chief mechanical engineer of the latter railway, the design being entrusted to R. C. Bond of the L.M.S., who was appointed the first superintending engineer. When Mr. Bond assumed the position of chief officer, locomotive construction and maintenance, of the Railway Executive, British Railways, the plant was placed under the superintendence of D. R. Carling, formerly test engineer, L. & N. E., who is responsible to R. A. Riddles, chief mechanical and electrical engineer of British Railways. The Great Western Railway built a locomotive testing plant at the Swindon Works in 1905, which has proved of value. This plant, however, is of moderate capacity and, due to refinements now available, the Rugby Station marks a considerable advance in the wider application of this method of testing locomotives.

In working out the design of this new test plant, due attention has been given to the other notable testing plants established at Purdue University, at Altoona, Pa., on the Pennsylvania, and the modern plant built by the French Railways at Vitry-sur-Seine, Paris. Work on the Rugby Testing Station was originally commenced in 1937, but was discontinued in 1940, remaining in abeyance until 1944 when steps were taken to revive the project, which resulted in its completion last October.

The testing station stands on a site of about 7¾ acres and is adjacent to the Rugby locomotive terminal and repair shops. It consists of two main buildings, with rail and road approaches. The larger building comprises the test house, the adjacent preparation shed, the coal bunker annex, and the foreman's office and messroom. The two former are over the boiler room for the heating installation. The smaller building houses the administrative offices and the chemical laboratory. This latter building, though near the main building, is sufficiently separated to be free of noise and vibration.

The Testing Plant

The testing plant, itself, is in the main test house, which is 171 ft. long by 66 ft. 6 in. wide, and consists of seven pairs of rollers which support the locomotive and up to five of which may be driven by the coupled wheels of the engine. Each of these five pairs of rollers is coupled to a Froude hydraulic brake, or dynamometer, capable of absorbing up to a maximum of 1,200 hp. The capacity of the plant is, however, rated at 4,500 hp., capable of being augmented to a maximum of 6,000 hp. Each roller unit has been designed to carry a load of 67,200 lb. The Froude brakes are arranged three on one side of the test bed and two on the other.

The characteristics of the Froude dynamometer are such that for any one setting of the controls of the locomotive and the brakes the combination of the locomotive and the brake is stable for any minor change of power output, only a very small change in speed resulting. The fundamental design of the dynamometer is such that torque increases or decreases as a function of the speed, thus providing the dynamometer with valuable self-governing properties which assist in the maintenance of steady speed irrespective of any adjustment of the controls.

The upper limit of power absorbed by the apparatus is governed by the permissible rise in temperature of the water circulating through the brakes. To keep the consumption of water within reasonable limits, this water is circulated through a cooler and again recirculated through the brakes. Within nor-

* Member, Institution of Locomotive Engineers.

mal climatic conditions the cooler will dissipate energy equivalent to a power of 4,500 hp., the maximum flow being 30,000 Imperial gallons per hour and the inlet and outlet temperatures about 140 deg. and 100 deg. F., respectively.

A proportion of water is evaporated in the cooler and is made up by an additional supply. Before a locomotive can be placed on the test plant, the plant must be adjusted to suit the wheel spacing of the engine. To enable this to be accomplished, the roller units and the brakes can be traversed along the sole plates. Each unit is provided with a motor-driven pinion working on racks extending over the whole length of the sole plates. Once correctly set, the roller units are firmly secured in position by large holding-down bolts. The rollers are, in the first place, set to the nominal dimensions of the locomotive and are then checked and reset more accurately by means of a special device originally developed at the locomotive testing station of the French National Railways at Vitry. This arrangement may be used either with the engine wheels stationary, or revolving at a slow speed, and is capable of indicating errors in centering of about 0.01 in.

The drawbar can be raised or lowered to suit the engine and the firing platform can also be adjusted to suit the locomotive foot plate.

A large damping dash-pot is fitted between the drawbar and the dynamometer to prevent excessive vibration arising from resonance of the elastic system composed of the drawbar itself and the mass of the locomotive.

The locomotive is actually placed on the rollers by means of a special lifting table extending the whole length of the test bed. This is composed of two heavy beams placed just inside the rollers and supported by jacks adjacent to each of the rollers. This table can be raised or lowered by a small amount so that, when in the "up" position, the locomotive is carried on the flanges of the tires only, while the actual treads are raised clear of the rollers. On the engine being correctly centered with the rollers, the table is lowered and the wheel treads then rest on their respective rollers.

The locomotive must, of course, be accurately placed on the rollers, as any departure of the locomotive axles from the verticals through the axle centers and those of the rollers induces a gravitational error in the recorded drawbar pull. For this reason the Amsler dynamometer is fitted with a mediating gear which automatically corrects this error. Further, it not only does this, but, at the same time, also records the error of position continuously and integrates the error in drawbar pull over the whole range of the test so that proper corrections can be made in recording the work done.

Soundproof Control Room

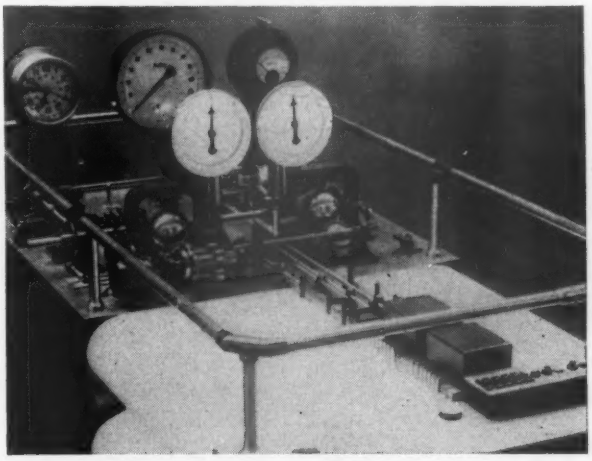
The main testing laboratory contains an internal two-story building of brick construction, the upper floor of which contains the control room where the majority of the recordings are made. This room is specially soundproof and has double doors and windows, since the noise level in the main building is likely to be considerable, more especially when high-power experiments are in progress.

The control room contains the Amsler recording table registering the drawbar pulls, the arrangement being like that commonly found in dynamometer cars. Electrical transmission is used between the locomotive wheels and the moving paper passing over the drums.

Other equipment includes a control desk, where the brakes and most of the other parts of the plant's machinery are controlled; the recording instruments for flue-gas temperatures, the temperatures of the inlet and exhaust steam, feedwater, etc.; the boiler, steam-chest and exhaust-steam pressures; the smokebox, firebox and ashpan vacuums, and the instruments for continuous flue-gas analysis.

The Amsler dynamometer is fitted below the control room and comprises a hydraulic cylinder fitted with a piston through which the pull exerted by the locomotive governs the pressure in the cylinder. The hydraulic pressure is shown on a gage calibrated to read directly in thousands of pounds pull and is also recorded by means of a small hydraulic cylinder and piston connected to a calibrated spring, and, finally, by a pen on the recording paper.

The Froude dynamometers are used not only as brakes controlling the speed of the locomotive, but are also fitted with arms which transmit the torque load to a spring. The deflection of this spring is



The recording table in the control room

The control desk from which the Froude hydraulic dynamometers and other machinery are tested

Movable chimney for disposing of locomotive exhaust

Three Froude brakes and torque recording equipment. The firing table is at center rear

transmitted electrically to the control room where the actual torque transmitted by each driving wheel is indicated in terms of tractive force at each axle. Each dynamometer can be controlled separately, or all may be adjusted at the same time by a master control. This enables the load on all driving wheels to be changed together, or the individual loads on each driving wheel may be altered separately.

Adjacent to the main test house is a coal bunker annex containing six bunkers each of 26,880 lb. capacity. These are loaded from cars arriving on a nearby track unloading across a platform at car-floor height and nearly level with the top of the bunkers.

A traveling hoist conveys the coal to the firing platform. The firing platform supports a coal bunker and shoveling plate forming part of a recording weighing machine, so that the amount of coal supplied and fired may be accurately known.

The water supplied to the locomotive is measured by means of a meter and by feeding from a calibrated tank, itself replenished in quantities of 500 Imperial gallons from two other calibrated tanks. Arrangements are provided to meter the amount of exhaust steam used by an exhaust-steam injector, or feedwater heater.

The main building of the test house is supported by a welded-steel rigid frame. In design it is unusual, as it not only has to support an overhead traveling crane, but a continuous slot was also required at the crown for the emission of smoke into the smoke chamber, and the latter, which is a concrete structure, has to be carried at this point. The roof covering consists of glazing and protected metal to reduce the load on the main structure.

The traction dynamometer is mounted on a heavy vertical steel joist which, in turn, is strongly braced to a large steel grillage, forming the base upon which the whole plant is mounted. This grillage contains about 60 long tons of steel girders and is embedded in a concrete block about 103 ft. long, from 17 to 41 ft. wide and from 6 to 17 ft. thick, weighing about 3,000 long tons.

The preparation shed alongside the test house has two tracks and is equipped with a wheel-drop capable of handling the largest locomotive driving wheels should it be necessary to remove an axle for any reason. There is also a small workshop.

The administration building, while near the test house, is, as already stated, sufficiently far from the test building as to be clear of vibrations. It contains the chief offices and the chemical laboratory, also a drawing office where all test data can be worked out and all graphs prepared. Through the courtesy of the Executive, British Railways, the writer has had an opportunity to inspect this notable locomotive testing station and has been provided with the photographs and other particulars upon which this article is based.

Electro-Motive Switchers

(*Continued from page 727*)

The range of services for which the locomotive is well adapted includes local freight, local passenger, mixed trains, yard switching, helper service, transfer service, and use in multiple with other GP-7 or other road power, hump switching, work trains and excursion specials.

The loaded weight of the GP-7 is about 248,000 lb. It is 55 ft. 11 in. long over the couplers, 31 ft. between truck centers, has a 9-ft. truck wheelbase, can negotiate a 150-ft. minimum radius and carries 800 gal. of fuel oil, 800 gal. of boiler water (optional), 200 gal. of lubricating oil, 230 gal. of cooling water and 18 cu. ft. of sand. The calculated tractive efforts for various speeds and gear ratios are shown in the diagram.

Railway Mechanical and Electrical Engineer

Beginning with the January, 1950, issue, this paper will appear as the *Railway Mechanical and Electrical Engineer*. This is a recognition of two facts: (1) that since the end of 1942 this publication has included an Electrical Section, and (2) that the number and importance of electrical installations in locomotives and passenger cars has been increasing steadily for some years.

The *Railway Mechanical Engineer*, founded in 1832 as the American Railroad Journal, is the oldest trade paper in existence. *Railway Electrical Engineer*, founded in 1908, was published until 1943. At that time it was merged with *Railway Mechanical Engineer*, since when this paper has served the needs of the two departments. Now the names of the two papers will be combined on the masthead.

From the standpoint of those of our readers whose interest is confined strictly to electrical installations and their maintenance, this recognition, no doubt, seems a tardy one indeed. However, when the *Railway Electrical Engineer* was combined with the *Railway Mechanical Engineer* in January, 1943, the United States had been involved in World War II a little more than a year. The merger was necessitated by paper shortage and various contingencies of the war. It was thought that the electrical paper might again be published when conditions became normal.

Accordingly, circulation department representatives began putting the question to readers in 1946. Electrical men were almost unanimously in favor of having an all-electrical paper, but serious opposition was presented by men in the mechanical departments. They said in substance, "We in the mechanical departments have great need for information on electrical subjects. We have become accustomed to finding it in *Railway Mechanical Engineer*, and we do not want to have to subscribe to two papers."

In fact the interests of the two departments are now so closely merged that the several railroad associations which deal with maintenance and operation of Diesel-electric locomotives, air-conditioned and electrically lighted passenger cars, completely new shop facilities, etc., have difficulty in knowing what subject to assign to what association and to what committee.

This situation has its counterpart in the publishing of this magazine. Every piece of electrical equipment is of necessity partly mechanical, and it has also come to pass that a large part of mechanical equipment used by the railroads is in part electrical. Furthermore, a considerable part of new information wanted by railroad men concerns electrical subjects. To conform with this situation, this paper will continue to deal with both electrical and mechanical subjects in the railroad field with acknowledgment to growing needs in the change of name. This change will be substantiated by an increase in the volume and scope of the electrical information published.

As has been the case during the past, it will continue to deal with matters of joint interest to both mechanical and electrical supervisors, as well as with matters primarily of interest to mechanical supervisors.

EDITORIALS

Brake Pipe Leakage Excessive

In spite of considerable publicity and more or less intensive work on many railroads, brake-pipe and brake-cylinder leakage is still giving trouble in freight-train operation. Defective gaskets are the most common cause, but numerous other details need constant attention in order to effect necessary improvements.

With the major objective of bringing brake-pipe leakage under control and holding it within desired reasonable limits, a new Note 5 was added to Interchange Rule 60, Par.1, requiring renewal of several important AB brake parts, regardless of condition, whenever the brakes receive periodic attention. These parts include the back-cover gasket, ball-check cover gasket, service-valve cover gasket and quick-service limiting-valve diaphragm.

The new note, effective August 1, 1949, may be removed if experience over a three-year period shows that the desired results are obtained. It was placed in effect, as stated in the note, "in order to overcome difficulties experienced during cold weather on account of excessive brake-pipe leakage in freight trains, many such parts now in service being made of synthetic rubber or being from 10 to 15 years old."

Air-brake manufacturers are making certain changes in the ball check and service portion back covers to eliminate warping. They also have developed a reconditioning die for straightening warped AB-valve service-portion back covers. For identification purposes this device has been assigned Pc. No. 539262. Further study also is being made to improve the gasket material.

A recent check of a 146-car train on an eastern railroad is reported to have shown undesired brake applications caused by brake-pipe leakage which increased from 5 lb. standing to approximately 12 lb. running. On further investigation, eleven cars were found with brake-pipe tee clamps and flange bolts loose; 19 cars had loose, missing or broken pipe-flange bolts on branch-pipe cut-out cocks; also numerous cars had loose bracket bolts on the AB pipe bracket, reservior, etc.

Conditions of this kind are responsible for excessive brake-pipe leakage, resulting in undesired brake application. In a recent circular letter, the A.A.R. Mechanical Division requests that every effort be made by all railroads to see that brake equipment and piping on freight cars is inspected and maintained in accordance with the current A.A.R. Instruction Pamphlets Nos. 2391, 2391-Sup. 1 and 5039-4, Sup. 1.

Portable Sand Facilities

One way to reduce the outlay required for the many Diesel shops required to handle the rapidly growing fleet of this type of power is to install portable sanding facilities in lieu of more expensive fixed sanding towers. The reduction will, of course, be merely a small percentage of the cost of a new facility, but it can amount to a fair portion of the cost of adapting an existing steam maintenance point to Diesel power where present sanding arrangements are located at a coal tripple some distance away or at some other point where it would not be convenient to sand Diesels. The installation of portable equipment is, at the same time, a manner of accomplishing a necessary objective that offers some auxiliary advantages in addition to the saving in cost over the fixed facility.

Two general methods of portable sanding have been adapted and considered satisfactory. One utilizes a power truck to which has been added a bin which holds about two tons of sand and is filled from an existing fixed sanding installation in the vicinity. Such an arrangement permits sanding the locomotive during fueling, or while work is being performed on it. The truck is free to go any place where a reasonably well paved surface is laid, including the interior of the shop. It can be used without difficulty to sand locomotives at passenger stations where servicing en route is given, or in freight yards where suitable paved surfaces are installed. The principal disadvantage of the truck is that its operation can be adversely affected, or even stopped completely, by ice or snow on the pavement, but this can be overcome by installing under-pavement heating or by clearing the roadway in other ways.

A second method which has been tried is somewhat of a compromise between the fixed sanding facility and the rubber-tired, gasoline-engine driven shop truck adapted to carrying and dispensing sand. It comprises a tank for loading, carrying and dispensing sand mounted on a four-wheel car truck. Its principal use will probably be found where an existing fixed

sanding facility is located some distance from where the Diesels are to be sanded, and where mobility of the sand car within the Diesel area is not of great importance. The principal reason for its portability is to move sand to the Diesel area, where it would normally remain in one place, and the locomotives be brought alongside for sanding. It has the advantages over the non-rail sand car in that it utilizes existing rails and can be used where no paving exists, and that it can easily be built to hold 10 or more tons of sand.

While only time will tell where and to what extent the various types of portable sanding facilities will fit into the economic picture of railroading, there appear to be enough advantages in the idea to merit some thought. One advantage to making a trial installation of portable sanding, while somewhat negative in nature, is that the comparatively low cost would not represent much of a loss in the event that fixed sanding facilities were later installed.

Trading Ideas

No industry can long survive in isolation. A manufacturer must remain in close contact with his field, he must know much about what his competitor is doing, he must constantly develop new ideas and he must exchange ideas on practice with his contemporaries. This is particularly true of a new industry of which the railroads' Diesel-electrical maintenance shops are an example. These shops are of necessity isolated from each other and the men who are responsible for their operation have little opportunity to visit other shops.

The need for exchange of ideas on practice was expressed by a member of the Electrical Section, Mechanical Division, A. A. R., speaking from the floor at the recent annual meeting. He said in substance that no one shop can be expected to develop all the good practices it needs, and if it is going to be really efficient and keep its costs down, it must be able to borrow ideas from other shops doing the same work.

A second member suggested that each shop operator should write in to the Association headquarters reporting on what he is doing, so that his developments might be reported to other members. It was generally agreed that such voluntary action could not be expected. One reason is that in many cases, the one who has found a good solution to a problem is not sure that the idea is new or, perhaps really good and he does not want to hear someone say, "Oh, we did that two years ago."

It was then suggested that a committee consisting of several members of the Section should visit the Diesel shops and report on their findings. This, if done thoroughly would take much time, probably much more than any shop operator could afford, and it did not receive the approval of the members present.

After the meeting, one of the operators approached the writer and said, "The *Railway Mechanical Engineer* is the only medium we have for the exchange of such ideas." We can scarcely concur with such an all-inclusive statement, but we can say that our pages are open for this purpose.

Such material is obtained for publication in several ways. First, by direct contribution in which someone with sufficient initiative sends in a description of some device or practice which he is pretty sure will be of interest to someone else. Such descriptions are usually accompanied by photographs or rough sketches. Finished drawings are not required, since they must almost always be redrawn with proper weight of line and letter size to provide for reduction in printing. All such material accepted is paid for.

Articles on shop practice are also obtained by members of the *Railway Mechanical Engineer* staff who travel extensively. They talk with men in the shops, take pictures and write articles. They also select subjects for the shop men to write about. If you will send us a story on what you are doing, or if you will tell us that you or someone else has developed a short cut or means of doing a better job, we will put your suggestion on our list of things to do. Such an exchange of ideas is essential to the extended use of Diesel-electric locomotives and to the creation of better jobs in the shops.

NEW BOOKS

THE STEAM LOCOMOTIVE IN TRAFFIC. *By E. A. Phillipson, A. M. I. C. E., A. M. I. Mech. E., M. I. Loco. E. Published by the Locomotive Publishing Company, Ltd., 88, Horseferry Road, Westminster, S W. 1, London, England. 252 pages, 6 in. by 8½ in., cloth bound. Price, 17/6.*

The original text of this book was written prior to World War II and was published initially in serial form in The Locomotive. The text for the book was set prior to the announcement of the British Railways regional titles now in effect, so references to the British railways remain in the terminology of the groupings of 1923. The national conditions of service for staff on the home railways quoted in detail in the original text have been omitted from the book which covers, in 12 chapters, steam locomotive operation, departmental organization, engine terminal layout and equipment, water supplies and treatment, boiler washing, storekeeping, locomotive inspection and maintenance, engine failures, etc.

SHOPS AND TERMINALS

Single Layout Cleans, Stores, Filters

All types of Diesel locomotive filters, air, fuel oil and lubricating oil, are cleaned and stored at a single location at the E. J. & E. Diesel shops at Joliet, Ill. The facilities at this point consist briefly of a cleaning vat; a monorail crane for dipping the parts into the cleaning vat and for transferring them; a long, heated metal cabinet, with an entrance on one end and exit doors along the sides near the other end, part of which is for drying and part for storing; and a rack for assembling drum-type filters with renewable inserts. The different types of filters are cleaned, dried and stored in slightly different ways as described below.

Rack for assembling cylindrical insert-type filters

All filters are cleaned in a boiling solution of Oakite Penetrate for a period of about five hours. Cylinder-shaped insert-type oil filters, such as the Michiana filter, are allowed to dry after removal from the cleaning vat. The old insert and the center insert brace are scrapped. A new insert and a new spring are applied, and the filters are stored on pegs which are located in one of the lower portions of the steel drying and storage cabinet.

Air filters are rinsed with a hose and plain water after removal from the cleaning vats. They are dipped in SAE 40 oil, placed on a special ball bearing holding rack which slides on a track in the heated portion of the cabinet, and dried by heat from steam coils within the cabinet. They are left in place on the rack for storage until ready to apply.

All filters are lowered into and raised out of the cleaning vat in a square basket by a 1-ton electrically operated traveling crane supported from a 5-in. I-beam which extends from the cleaning vat to the drying and storage cabinet. Movement of the filters within the heating and storage cabinet is by three principal means. Small cylindrical filters and half-moon-shaped filters are hung on the special rack previously mentioned which has ball-bearing trolley wheels that ride on a monorail through the heating section of the cabinet on one side. Small rectangular-shaped filters, such as the Farr filters used on Electro-Motive switchers, are set on a pair of endless chains and moved through the same portion of the cabinet by a crank attached to a pair of chain pulley wheels

Left: Small cylindrical filters are stored on pegs in the bottom of the metal cabinet—Center: Drum-type filters are rolled through the cabinet on four metal strips—Right: Rack for holding and moving small filters through the drying portion of the cabinet

at one end. The edges of the flat filters touch flanged sides of the cabinet at the two extremities of travel to prevent the filters falling off the chain and dropping to the floor if the doors are open. Large cylindrical or drum-type, filters are rolled through the other side of the heating section on four lengths of strap iron 3/8 in. by 1½ in. laid vertically in the bottom of the top half of one side of the cabinet. These are welded to 1-in.-cubic blocks set every 2 ft. along the bottom.

An added aid to the transfer of filters from the cleaning vat to the cabinet is a table that extends between the two and slides back and forth across the two entrances to the cabinet. The table slides in two 5-in. channel sections, which catch any oil that drips from the filters and keeps the floor clean. These channels also serve to catch the oil that has dripped into the cabinet. The floor of the heating portion slopes slightly to drain the oil into the channels, and the channels slope slightly back to the oil tank to return the oil to the sump. The table is made from 3/16-in. steel and has a 1-in.-square steel strip down the center of the bottom for reinforcement. It can be locked in place at any position of its travel by a cam-type lock operated by a handle.

The cabinet is constructed from 1/8-in steel. It has five doors on the bottom of one side and two on the top; the other side has four doors on top and five on the bottom. All doors are 3 ft. square and mounted on hinges. For drying, the cabinet has a coil of 12 lengths of 1-in. steam pipe on the top half which run within 6 in. of each end. Steam at 80-lb. pressure is normally carried in the coils.

The cabinet is vented on top for safety. It also has two openings 12 in. by 18 in. on the top which are covered only by sections of 1/8-in. steel to provide instant relief for any accumulated pressure. As a final precaution there is a steam smothering valve controlled by a reach handle on a nearby post. Opening this floods the cabinet with live steam.

At the end of the cabinet opposite the cleaning-vat end a rack has been installed by assembly cylindrical insert-type filters. This rack is made from channels 1/8 in. by 2 in. by 12 in. welded together and bolted to the floor. The bottom horizontal channel is about 14 in. above the floor and the top 3½ ft. Six holes are cut out of the top section to permit the filter shells to drop through and to rest on six hard-wood blocks 6 in. in diameter and 1½ in. high which rest on the bottom horizontal channel and support the filters.

Bin for Bolts and Nuts

A circular revolving bin for storing miscellaneous sizes of nuts and bolts has been built for the Diesel shop of the Louisville & Nashville at South Louisville, Ky. The bin offers quick access to any of its forty compartments and takes relatively little space. It is so constructed and balanced that no permanent mounting is required, and if a change in its location should be desired, it can be picked up with the crane.

The circular bin stands about 6 ft. high, has an outside diameter about 30 in., and is made of 1/8-in. steel. There are five rows of compartments 12½ in. deep. The front edges of all these compartments are made from 1/8-in. by 2-in. strap iron bent to the circumference of the bin. The top and bottom of the bin is supported on ball bearings.

Truing Up Worn Chuck Jaws

By J. R. Phelps

An accompanying illustration shows a good way of holding lathe chuck jaws in their proper position (that is with the pressure out, which is the position they are in when clamping a job) while grinding the inside face of the jaws. When chuck jaws get worn and need grinding, they may be set up against a notched ring, which is centered, and a small tool post grinder is used to clean them up. The chuck jaws are then taken out and grooved to restore full holding power. When cleaned and put back in the chuck, they should clamp down perfectly and bear full length on any true piece of work.

The notched ring shown is used with four-jaw chucks and is 4½ in. outside diameter, by ¼ in. thick, by 1 3/16 in. wide, with four notches 1 25/32 in. long by ½ in. wide, bevelled to fit over the points of

Ring used while truing worn chuck jaws by grinding

the chuck jaws which are thus exposed for contact with the grinding wheel. Pressure of the jaws against the ring takes up all slack in the adjusting screws. In the case of three-jaw chucks a smaller ring, 3½ in. outside diameter, 5/16 in thick and 1½ in. wide, with three equally-spaced slots 2 1/32 in. long by 5/8 in. wide, is used.

Gauge Checks Valve Stem Length

A simple but useful gauge for checking the valve stem lengths on Diesel engines has been constructed from a dial indicator and a short length of steel tubing by shop personnel of the Louisville & Nashville at South Louisville, Ky. The steel tubing has a 2½-in. outside diameter and is 5/16 in. thick. It has four slots 1 in. wide by 7½ in. long to reduce the weight.

One end of the tubing is machined out to the same taper as a Diesel engine valve seat. A cap with a 5/8-in. hole is welded to the other end of the tubing to serve as a guide to the valve stem and keep it concentric with the tubing. A dial indicator is mounted on a length of 3/8-in. rod, which is welded to the tubing. The indicator is centered over the 5/8-in. hole. When a valve is seated in the gauge with the stem through the guide hole, it is a matter of seconds to determine by indicator reading whether or not its length is within the required tolerance.

Checking the length of a Diesel locomotive exhaust valve with the valve-length gauge

Centering Work On a Boring Mill

By J. R. Phelps

An accompanying illustration shows a valuable gauge for locating work on a boring mill table. The distance from the face of the rail to the center of the table must first be carefully determined. Then, in making the gauge, be sure to maintain this distance accurately. Drill two dowel holes ½ in. diameter near the outside through the top flange of the gauge. Place the gauge on the boring mill rail and space it right or left exactly in the center of the table. Drill two dowel holes about 5/8 in. deep into the rail and put the dowels in the gauge.

When thus positioned, the gauge instantly drops into proper place and any job can be set up within 0.01 in. without preliminary turning of the table. This is more accurate than using a surface gauge with a round base which fits in the hole in the center of the table. Also the method described can be used on any kind of work, solid or hollow.

The gauge consists of a T-shape bracket, made of 13/16-in. steel, 10 in. wide across the top where a flange bears on the boring mill rail, the vertical member of the gauge being the same length as the rail is wide. Two outward projecting arms of the gauge support brass center post bushings, knurled lock nuts and sleeves and the revolving center post holder which is 1 3/32 in. in diameter by 18 in. long and has a 60 deg. angular point and a scriber, as illustrated. All bearing parts are machine finished and the center post is accurately centered both ways over the boring mill table.

Gauge for centering work on boring-mill table

Questions and Answers

The question and answer department is included for the benefit of those who may desire assistance on problems involving matters pertaining to the operation or maintenance of air brakes, Diesel-electric locomotives, steam locomotive boilers or steam locomotive practice. Any inquiry should bear the name and address of the writer, whose identity will not be disclosed unless special permission is given to do so. Anonymous communications will not be considered. Inquiries addressed to this publication will be referred to the source from which an authoritative answer can be secured.

Steam Locomotive Practice

By George M. Davies

Overload in Testing Springs

Q.—In testing locomotive driving springs after making necessary repairs, which consisted of two new leaves and spring band, what overload should be placed on the spring?—A. R. B.

A.—The general practice after repairing semi-elliptic driving springs is to test them for the working load and 50 per cent overload. Starting with the spring fully released, pressure is applied to 50 per cent over working load and then released to working load, height measured should not be over but may be $\frac{3}{8}$ in. under the working height specified for the spring, the pressure is then fully released and the height measured. If difference between original free height and free height after test is not more than $\frac{1}{32}$ in. under specified height the spring is acceptable. With the working load still applied, the loaded length should not vary more than $\frac{1}{4}$ in. from that specified.

Determining Number of Studs for Cylinder Head

Q.—Our Pacific-type locomotives have twenty-four 1¼ in. studs for securing the cylinder heads. Is this number of studs sufficient for a locomotive operating at 200 lb. per sq. in. working pressure?—R.I.K.

A.—The total cross-sectional area of all the studs is determined from the formulae:

$$A = \frac{0.7854 \times D^2 \times P \times S}{T}$$

$$A = \frac{0.7854 \times D^2 \times P \times S}{T}$$

where

A = Total cross-sectional area of all studs in sq. in. at root of thread or breakage groove.
P = Boiler pressure, lb. per sq. in.
D = Diameter of cylinder head joint, in.
S = Factor of safety.
T = Ultimate tensile strength of material in studs, lb. per sq. in.

Assuming that

$P = 200$, $D = 25$, $S = 8$ and $T = 60{,}000$

$$A = \frac{0.7854 \times 25^2 \times 200 \times 8}{60{,}000}$$

$A = 21.27$ sq. in.

The number of studs required is determined from the formulae:

$$N = \frac{A}{a}$$

where

N = number of studs
A = Total cross-sectional area of all studs in sq. in. at root of thread or breakage groove.
a = Cross-sectional area of one stud, sq. in. at root of thread or breakage groove.

Assuming that

$a = .893$ sq. in.

then

$$N = \frac{21.27}{.893} = 22.4 \text{ or } 23 \text{ studs required.}$$

Under these conditions the 24 studs are sufficient for securing the cylinder head.

Pattern Indicating Colors

Q.—What are the designated colors for pattern equipment? Are all patterns painted in a uniform manner?—R.E.V.

A.—The standard colors for wood patterns and core boxes as approved by the U. S. Department of Commerce, Bureau of Standards, are as follows:

1—Surfaces to be left unfinished are to be painted black.
2—Surfaces to be machined are to be painted red.
3—Seats of and for loose pieces are to be marked by red stripes on a yellow background.
4—Core prints and seats for loose prints are to be painted yellow.
5—Stop-offs are to be indicated by diagonal black stripes on a yellow base.

Some variations in shades of the above colors are permissible within reasonable limits. The colors may be obtained by mixing suitable inexpensive pigments with varnish or shellac to produce the type of coating desired.

Steam Locomotive Boilers

By George M. Davies

Flexible Stays and Breakage

Q.—How do the flexible staybolts used in the side sheets of a locomotive boiler reduce staybolt breakages? —F. R. Q.

A.—The flexible staybolt reduces staybolt breakage as compared to the rigid staybolt by reducing the

bending stresses in the staybolt. The typical flexible staybolt with its ball and socket joint in the outer sheet reduces the bending stress at this location to practically zero, as long as the ball and socket joint remain free. The bending stress at the fire sheet is theoretically reduced to half that of the rigid staybolt by doubling the effective length of the beam now acting as a simple cantilever with a load concentrated at the wrapper sheet end.

Stress on Brace Rods

Q.—The A.S.M.E. Code allows a maximum stress of from 8,500 to 9,500 lb. per sq. in. on unwelded round brace rods and 6,600 lb. per sq. in. on welded brace rods for locomotive boilers. Does this apply to all locomotive boilers?—V. M. P.

A.—This applies only to locomotive boilers built in accordance with the A.S.M.E. Code and not operated under the jurisdiction of the Interstate Commerce Commission. The laws, rules and instructions for inspection and testing of steam locomotives and tenders and other than steam locomotives issued by the I. C. C. Bureau of Locomotive Inspection, provides that the maximum allowable stress per sq. in. of net cross-sectional area shall be 7,500 lb. for staybolts and 9,000 lb. for round, rectangular, and gusset braces, with no provision for the use of a welded brace.

Firebox Temperatures

Q.—Please furnish information in connection with the temperatures obtained in the firebox of a modern coal burning locomotive.—E. H. V.

A.—The temperatures in the firebox of a modern boiler equipped with combustion chamber and firebrick arch will range from 2,000 to 2,500 deg. F.

Stationary tests with a Niagara type locomotive indicated the following firebox temperatures:

Firing rate coal per hr. (tons)	Firebox temperature Under arch (Deg. F.)	Over arch (Deg. F.)
4	2,210	1,880
7	2,230	1,850
10	2,530	2,310
13	2,600	2,340
16	2,670	2,430

Information For Alteration Reports

Q.—When filing an alteration report covering a boiler patch for a locomotive boiler, what information should be shown on the sketch of the patch submitted with the report?—R. E. F.

A.—Rule 54 (b) of the laws, rules and instructions for inspection and testing of steam locomotives and tenders and other than shown locomotives as prescribed by the I. C. C. Bureau of Locomotive Inspection, states as follows:

Report of patches should be accompanied by a drawing or blueprint of the patch, showing its location in regard to the center line of boiler, giving all necessary dimensions, and showing the nature and location of defect. Patches previously applied should be reported the first time the boiler is stripped to permit an examination.

Rule 54 (b) has been interpreted as follows:

An accurate description of alterations should be made. Drawings of patches should show whether the plate underneath patches was removed, the location and extent of cracks, pitting, corrosion, and grooving should be shown and dimensioned if the defective plate was not removed, the size of rivets and the size of rivet holes should be given, and the reports should state whether iron or steel rivets were used. If authentic records of tests of material used in making repairs are available the lowest tensile strength as shown by test should be given; otherwise 50,000 lb. for steel and 45,000 lb. for wrought iron will be allowed as provided by Rule 4. It is not necessary to report patches on surfaces supported by staybolts.

Schedule 24RL Air Brakes

EMERGENCY POSITION (CONTINUED)

850-Q.—What action takes place at the control valve? A.—The emergency rate of brake pipe reduction causes the emergency piston and slide valve to move to the left. Quick action chamber pressure cannot reduce through the vent port *t* in the graduating valve and port *v* in the slide valve to the atmosphere at the same rate, building up a differential across the emergency piston.

851-Q.—What happens then? A.—Spring *34* is compressed, allowing the graduating valve to move far enough to open port *t1* in the slide valve which is connected to port *14* in the seat, allowing quick action chamber air to flow to the face of the vent valve piston *40*, unseating the vent valve, permitting a large and direct passage from brake pipe passage *1* to atmosphere. The rapid venting of brake pipe air causes an emergency rate of brake pipe reduction throughout the train.

852-Q.—Is there any further movement of the emergency piston? A.—Yes. The emergency piston now moves to the extreme left, due to the rapid reduction of brake pipe pressure, moving the slide valve with the piston.

853-Q.—What changes are made in port connections with this movement? A.—Port *t1* is now out of register with seat port *14*, but port *14* is now uncovered in the slide valve seat so that quick action chamber pressure remains connected to the vent valve piston.

854-Q.—What other connections does the slide valve make at this time? A.—The spring side of high pressure valve *46* is connected to the exhaust port, *At*, through passage *18* and cavity *h3* in the slide valve. This vents air pressure from the spring side of the high pressure valve.

855-Q.—What happens then? A.—Emergency reservoir air in passage *2*, acting on the outer area of the face, unseats the high pressure valve, permitting the emergency reservoir air to flow through passage *3h*, *3a* and *3* to the displacement reservoir.

856-Q.—What controls the rate of flow to the displacement reservoir? A.—Choke *4* in passage *3h*.

857-Q.—What action has taken place in the service portion? A.—The service piston and slide valve have moved to the extreme right, the graduating valve uncovering the service port *n*, through which auxiliary reservoir air flows into passage *3c*, choke *3*, passage

3a, and to the displacement reservoir passage *3*, combining with the flow from the emergency reservoir.

858-Q.—Is the safety valve connected in emergency position? A.—No, the safety valve passage *17* is blanked by the emergency slide valve.

859-Q.—Why is the rate of exhaust of quick action chamber air timed so that the vent valve will remain open a definite length of time? A.—First, to insure transmission of quick action and second, to insure closing of the exhaust so that the brake pipe pressure can be restored when desired.

Emergency with Controlled Brake Cylinder Development for Long Trains

860-Q.—How is the controlled build-up of brake cylinder obtained? A.—The Rotair valve is moved to Frgt position where main reservoir pressure from passage *30* flows to controlled emergency pipe *35* to the *D-24* control valve.

861-Q.—Trace the flow of air through the control valve. A.—Through passage *35* to chamber *B* below piston *187* of the controlled emergency portion. Piston *187* is moved upward and unseats small check valve *185*, thus connecting chamber *D* on the left side of diaphragm *201* to chamber *A* and passage *3h*.

862-Q.—What takes place when an emergency application is made? A.—Emergency reservoir air in passage *3h* flows to the controlled emergency portion, chamber *A*, past unseated check valve *185* to chamber *D*. In chamber *D* the diaphragm is moved to the right, compressing spring *209*, seating valve *199*.

*Diesel Locomotives**

Q.—What supercharger manifold pressure is required for best operation?

A.—On the 12½ by 13-in. Alco engine a manifold pressure of 4½ lb. per sq. in. is to be desired. The manufacturer recommends that the supercharger be returned for reconditioning every four years on switchers and every two years on road switchers.

Q.—When should a fuel injection pump be condemned and on what basis?

A.—The life of a fuel pump depends on operating conditions such as cleanliness of the fuel oil and freedom of the fuel oil from water, and averages five years in normal switching service. Locomotives operating under high load factors will obtain reduced fuel pump life. The pump should be calibrated with an authorized calibration stand to meter the fuel accurately. A faulty pump is indicated by a loss of power in the engine and a low temperature in the exhaust elbow of the affected cylinder.

Q.—What is the physical difference between the 660- and 1,000-hp. fuel pumps?

A.—There is no marked external physical difference except the identification plate which has the type number AP FID 160-T-82 indicating the 660 pump and type number AP FID-200-T-82, indicating the 1,000-horsepower fuel pump. Pumps on which the identification plate has been lost, removed or mutilated should be returned for testing and the application of a proper identification tag.

Q.—If fuel is metered by the fuel pump to the nozzle, why is a drain from the nozzle necessary?

A.—Fuel oil is used to lubricate the steel upon steel sliding surfaces found in the fuel pump and injector. Although the major portion of the fuel oil is ejected through the spray holes, a certain amount of it is forced back through the clearance between the needle valve and nozzle body, resulting in the required lubrication. This oil which passes the needle valve is then drained.

Q.—How is a fuel pump timed?

A.—Set the first line on the crankshaft to coincide with the crankcase pointer. The No. 1 and No. 6 pumps can now be timed by raising or lowering the crosshead tappet until the line on the pump plunger is line in line with a similar line on the pump housing. No. 2 and No. 5 pumps and No. 3 and No. 4 pumps are similarly timed by setting the crankshaft at the second and third timing lines respectively. If there is any doubt as to the accuracy of the pointer or lines, a bevel protractor should be employed to time the pumps.

Q.—On Alco switchers where the high voltage cable shows megger readings of 50,000 ohms to ground, what procedure should be followed to clear this up before a high potential test is applied?

A.—Any ground below one megohm should be isolated and the cause determined. If the ground is in the generator it is usually due to dirt in the generator. Grounding of the risers or string bands to the frame will cause a low megger reading. If the ground is in the cable, it is usually best to replace the cable. Failure to correct the ground will probably result in a serious flashover. Removing the rubber grommet at the end of the cable conduit and blowing the conduit out with compressed air to clear up grounds is easier than removing the cable, and if it clears up the grounds it serves its purpose.

Q.—How does the electrical control circuit fit into the fuel system?

A.—There are three remotely controlled magnet valves in the governor. The movement of the throttle energizes these magnet valves which in turn cause the grasshopper mechanism to actuate the racks thereby regulating the amount of fuel injected.

Q.—Why do traction motor brushes chip and break?

A.—There are several causes. Operation of the locomotive over right-angle crossings, which are more damaging to brushes than diagonal crossings, will cause the traction motors to bounce and jolt the brushes, causing them to chip. The throttle should be closed to some lower notch or position to reduce the tendency of the brushes to act like an arc welder drawing an arc and resulting in a flashover. The force of a flashover, if it occurs, may cause pitting and breakage of the brushes. Many times electricians raise the brush holders and let them snap back into position when making inspections. This causes small chips to be formed resulting in a weaker section in the brush and eventually in the formation of larger chips.

* These questions and answers were submitted following a talk at the August meeting of the Chicago Railroad Diesel Club by Chase Sherman, American Locomotive Company, on the fuel injection system of the Alco, 12½-in. by 13-in. engine.

CAR INSPECTION AND REPAIR

Great Northern Box Cars

Jig for welding center-sill sections together

THE Great Northern recently completed at its St. Cloud, Minn., shops the last of an order of 2,000 50-ft. steel box cars, 1,500 for that road and 500 for the Spokane, Portland & Seattle. These cars have welded steel underframes, two-piece welded steel ends, riveted sides and roofs. The light weight of the cars varies somewhat and averages about 40,200 lb. which gives a load limit of 128,800 lb. The inside dimensions are 40 ft. 6 in. long, by 9 ft. 2 in. wide, by 10 ft. 2 in. high, giving a cubic capacity of 3,769 cu. ft.

The underframes, built at the company shops, Superior, Wis., were shipped to St. Cloud where the cars were completed on two assembly lines turning out 22 cars daily, a new production record for St. Cloud shops. The underframe construction is interesting because of the limited shop area available, and because of the shop-made jigs and the procedures followed.

The fabrication and assembly of the underframes is divided into three separate yet well integrated groups of operations. These are: Fabrication and assembly of center sills; fabrication and assembly of bolsters, cross bearers and cross ties; final assembly of complete underframe.

The fabrication and assembly of center sills consists of eight major operations:

1—Punching center sill flanges and webs.

2—Center sill sections welded in a jig by the automatic submerged arc process. Twenty-four air-operated clamps hold the two sill sections in alignment on frame supporting copper backing bar. Full penetration through the flanges is attained. Twelve sills are welded in eight hours.

3—Sills are checked for length and cut to 41 ft. ½ in., if necessary.

4—Inside of center weld is rechecked to make sure there will be no interference with end castings.

5—Combination buffer and front lug casting, combination rear draft lug and center filler casting, bottom bolster tie plate and center plate are tack welded in place.

6—The center sill is placed in a revolving jig and the parts listed in Operation 5 are all completely welded, the assembly being turned so that all welding is downhand. While the sill is in this jig, the spreaders and rod carriers are placed and welded.

7—The sill assembly is removed from jig and placed on stands, and the draft gear, coupler and centering device installed.

8—The complete assembly is moved to yard and stored to await final assembly of underframe.

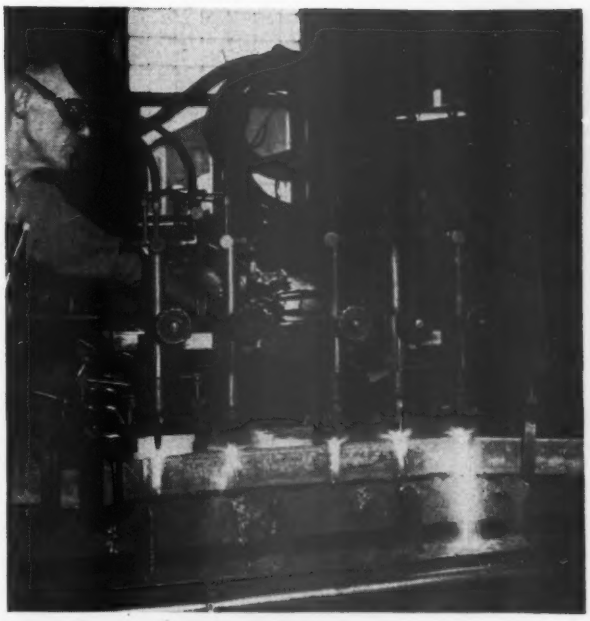
The fabrication and sub-assembly of bolsters, cross bearers and cross ties proceeds in ten separate operations:

1—The web sections are cut from $\frac{5}{16}$-in. plate. These are cleaned by buffing, then stacked ten high and clamped to cutting bed. Little adjustment of the torches is required. These sections are cut to a tolerance of $\frac{1}{32}$ in.

2—Web sections are punched to provide openings for air and signal trainlines, and for reinforcing spacers between bolster web section.

3—Cover plates cut for length.

4—Cover plates punched for floor bolts and for access hole to side bearing and decking bolts.



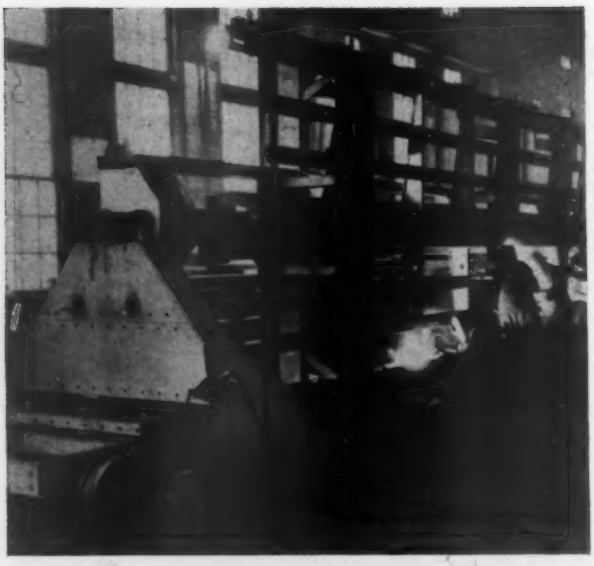
Stack-cutting ten 5/16-in. steel plates for web sections

Assembling and tack welding bolsters in positioning jig

5—Bottom cover plates bent to shape of lower edge of web section.

6—The body bolsters are assembled and tack welded in a positioning jig. Two jigs are used, so that while the sections are being placed in one, a welder can tack-weld on the other. The use of toggle clamps, locking sleeves and the arrangement of the web plate guide results in the operation being simple and economical. Three men produce 27 to 29 car sets in eight hours.

7—The tack welded bolster sections are transferred to an automatic welder by a roller conveyor.



A combination copper weld backing bar and positioning frame is inserted into the bolster section. The backing bar device is expanded to fit by a screw arrangement on the positioning shape.

8—The bolster section is lifted to a positioning jig and automatically welded by a submerged arc welder. Four such jigs are used. After all four fillets are welded on each bolster section, they are removed and braces, stiffeners, top side bearings, etc., are hand welded into place. The completed sections are stored outside, preparatory to final assembly.

9—Cross bearers and cross ties are assembled in a similar manner, except that all welding is by hand rather than by automatic welding. After completion, these too are stored.

10—Miscellaneous parts such as brake equipment brackets, floor support Z-bars, rod and lever carriers, etc., are fabricated and stored.

The final assembly of the underframes is carried out on one track in eight operations, as follows:

1—A locomotive crane takes the center sill assembly from the stock pile and places it on the assembly jig outside the shop. Seven such jigs are used.

2—The jig is moved to the stock pile of bolsters, cross bearers, cross ties, floor supports, etc., where these are put in place.

3—The jig is pulled into the shop. In the first position, arc subassemblies are accurately positioned and clamped into place.

4—In the second position all of the welds on the top of the underframe are made by hand welding.

5—In the third position the bolster cover plates and various brackets are applied and welded.

6—Upon arrival of jig at the fourth position, the jig is raised from transporting carriers and supported by the jig trunnions on movable stands, so that the frame can be rotated for all bottom and side welding. At this position the various welds are in-

Top left: Underframe vertical for downhand welding at side sill—Center left: How the bolster section is welding in special jig—Below: Copper backing-bar device used in welding body bolster sections

spected and defects marked. Upon completion, the frame is returned to the carriers and pulled out of shop.

7—Outside the shop the welds are cleaned, and any touch-up welding taken care of. Final inspection is made.

8—The locomotive crane loads the frames on a flat car—five frames to the load. After being blocked and secured, the frames are spray primed. They are then shipped to the shop where the remainder of the construction is carried out. The production has been at a rate of 14 frames each eight hours.

Equalizer Handling Cart

Passenger car equalizers need only be handled twice for all reconditioning operations between removal from the car and reapplication through the use of a cart built at the Wabash shops at Decatur, Ill. Cleaning the equalizers and building up the wearing surfaces can be done without disturbing the position of the equalizer undergoing the cleaning or welding operation; neither is it necessary during these operations to disturb the position of any of the other equalizers in the set of eight which are held by the cart at one time.

The cart rides on four rubber tired wheels 16 in. by 3½ in. mounted on 2½-in. axles. The frame is supported at the rear by a section of 8-in. I-beam with a 20-in. base and a 10-in. top set directly above the rear axle. The front portion of the frame rests on two 4-in. I-beams set lengthwise with respect to the cart and 13-in. apart. Both the front pair of I-beams and the rear I-beams rest on the axles through blocks 4 in. by 4 in. by 2 in. Two intermediate supports consisting of plates ¼ in. by 14 in. by 14 in. between the top of the front I-beams and the front of the frame permits turning the front pair of wheels for maneuverability. The bottom plate is welded to the top of the 4-in. I-beams, and the top plate to the bottom of the frame through two sections of scrap iron ½ in. by 2 in. by 2 in. The two plates are held loosely together at the center by a bolt which permits the bottom plate to swivel about the bolt and about the top plate. This allows the front wheels to be steered.

A 1-in. bolt 18 in. long fits through two holes in the two 4-in. I-beams. A third 4-in. I-beam, 27 in. long, has a hole drilled near one end through which the bolt slips. This third I-beam forms the coupler by which the cart is towed with a power truck. It has a section of ¾-in. plate, shaped to form a hook, welded to the free end. The fixed end is held in proper position by two Z-shaped ½-in. straps, one on each side of the handle, with a hole in one flange of each for the bolt to slip through. The Z-shapes are double-riveted on the other flange to the handle.

The main frame is made from angles 4 in. by 3 in. by ¼ in. with the 4-in. side vertical. The four main uprights are 3 in. by 3 in. by ¼ in. The strap iron along each side is ½ in. by 1½ in. The two angles across the top between the main uprights are 3 in. by 3 in. by ¼ in. and support the equalizers.

The end sections which hold each end equalizer are welded to the cross angles on which the equalizers rest.

The cart is of welded construction except where main angle sections are joined together; at such points both rivets and welding are used.

Single Jack Raises Car Ends

A private car company has adopted as standard practice two procedures which have greatly increased the efficiency of car repairs and material handling. Asphaltic concrete 5 in. thick is applied not only between adjacent tracks in repair yards but also to the area between the rails. This permits the various material handling trucks to cross the tracks at any point and provides a level surface throughout the yard which greatly increases the efficiency of shop operations. Furthermore, this level surface is easier to keep clean and prevents loss of small items of material.

With this hard surface only one man with one

The 35-ton pneumatic jack in place for raising a tank car end with a single jack

jack is required to raise the end of any empty car for the removal of a truck, and no additional base or blocking for distributing the load of the jack is necessary. A new design of Duff-Norton air-operated rubber-tired jack with a capacity of 35 tons and an extra-wide base is used for this purpose. The jack is used at any point in the repair yard where only one end of the car is to be raised. The truck under the car at the opposite end eliminates any possibility of the car tipping over while being jacked, and no precautions are necessary at the other end to prevent tipping the car With the paving, the jack rests directly on the finished surface.

The jack fits under the integral coupler carrier or between the center sills using a specially designed jacking plate to raise the car. The jacking plate is approximately 1½ in. by 6 in. by 21½ in. It has two stops which fit just inside the center sill, and a waffle-iron effect just outside the sill. The jack head fits inside a ring welded to the center of the underneath surface of the plate.

After the car has been raised by the jack to the height desired, a specially designed steel horse, which rests on the rails is placed directly behind the truck to be removed. To overcome the possibility of slipping, a hard wood 2 by 4 is securely bolted to the top of the steel horse.

Decisions of Arbitration Cases

Wood Running Boards Damaged in Other Repairs

The Mather Stock Car Company rendered bill No. 50322 against the Chicago, Rock Island & Pacific which included charge for repairs to ESLJ 5009 on authority of defect card. The damage listed on the defect card included 11 roof sheets bent and buckled, 8 metal carlines bent and buckled, 1 metal side plate, left side, bent and 10 feet of floor nailer AL-damaged by fire. The C., R. I. & P. took exception to the charge for 80 ft. of running board 1 in. by 6 in.—$14.96, claiming the charge should be per Item 143-A, Rule 107, in accordance with Arbitration Case 1043. Mather contended that the running board was broken in removal to renew the roof and the charge was correct.

The C., R. I. & P. contended that the charge for the running board removed to renew the roof sheets should be per item 143-A, Rule 107, no charge for material, because of the ruling in Case 1043. This decision is of long standing but there appears to be some doubt whether it should apply to present-day cars, nearly all of which have bolted running boards.

Mather contended that the C., R. I. & P. defect card covered 11 roof sheets bent and buckled and in order to repair this damage it was necessary to remove 80 ft. of running board. The running board detail on this car consists of 1¼ by 6 in. boards screwed to oak saddles which are bolted to saddle castings. Mather's experience shows that the corrosive action of the tannic acid on the screws makes their removal impossible in almost all cases. Consequently the running board is damaged in removal to such an extent as to be unfit for reapplication. Mather did not consider Case 1043 applicable. In Case 1043, the question submitted to arbitration was whether the charge for a complete roof and running board was equitable when the chief interchange inspector had stated only 32 roof boards and 3 roof sheets were damaged. In the case at hand the running board was damaged in removal to repair defects fully carded for. Mather felt that parts damaged in removal to repair delivering line defects are correctly chargeable to the road which creates the carded damage.

In a decision rendered April 7, 1949, the Arbitration Committee said that in making repairs requiring the removal and replacement of wooden running boards, it is generally recognized that some damage to same may occur. The contention of the car owner was sustained. This renders the decision in Case 1043 obsolete. *Case 1832, Chicago, Rock Island & Pacific versus Mather Stock Car Company.*

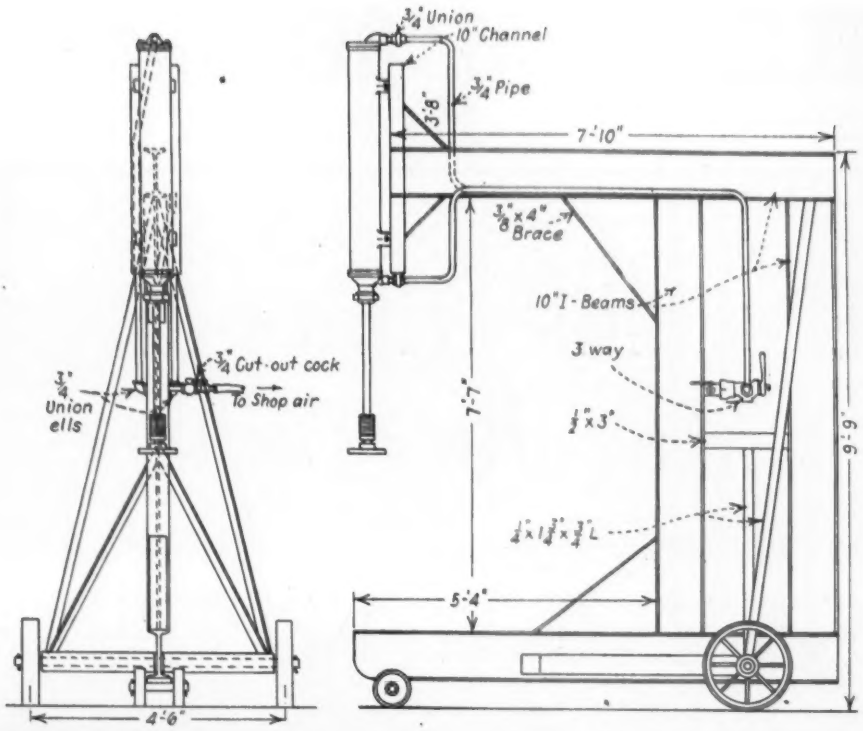
Car Floor Press

The tongue-and-groove boards which form a box car floor are pressed tightly in place at the Centralia, Ill., car shops of the Illinois Central with rapidity, ease and safety to the men on the job by means of an air-operated car floor press. The undercarriage of the press is blocked against the under side of the car center sill to form the support for the pressing operation which is performed by an air cylinder mounted on the top frame of the press. Controls for operating the press are located on the vertical column, which also includes a step and a platform on which the operator can stand while controlling the movement of the piston. The entire press is carried on one pair each of small and large wheels for easy movement by hand to and from its working location.

After all but the last nine floor boards are in place, two sections of the floor on either side of the center of the car are partially drawn up with a sledge. Two groups of boards are then nailed together to fill in this center section. One group has four tongue-and-groove boards while the second has four tongue-and-groove boards and a key board. After each group of boards has been fitted together, they are held by nailing to a length of strap iron ½ in. by 2½ in. by 30 in. The two board groups are then set in place.

The press piston is lowered to within a few inches of the intersection of the two sloping groups of boards and a holding board 2 in. by 7 in. by 3 ft. is inserted between the press and the intersection of the board groups. A V-notch 3 in. long and ½ in. deep is cut in the holding board. The center of this notch fits over the intersection between the two board groups and prevents them from slipping out. After all the floor boards have been forced together tightly by

Details of the car floor press used at the Illinois Central, Centralia, Ill., car shops—Below: The press in position for beginning the operation of wedging the car floor boards tightly together — The board between the press and the intersection of the sloping groups of floor boards has a V-notch to hold the sloping groups during the pressing operation



Right: At the completion of the stroke of the airpiston the floor boards are forced tightly together—Wedges are then inserted under the threshold plate angles to hold the floor in place until the floor bolts are applied

pressing the two groups of boards to the horizontal position, wedges are applied under the threshold plate angle to hold the flooring in place until the bolt holes are drilled and the bolts applied.

During the operation of pressing the two groups of nailed center boards in place to force all the tongue-and-groove boards snugly together the previously laid boards are held in place by four lengths of angles 3 in. by 3 in. by ⅜ in. which extend from the edges of the door openings to the ends of the car. Notches are cut in these angles at certain locations to accommodate extra-long bolts that hold the transom boards.

ELECTRICAL SECTION

Electrification of Machine Tools

Shop schedules postponed by the war, many new types of equipment in service and the increased cost of labor all demand machine tool improvements

*By V. P. Schmidt**

THE Pennsylvania has constantly under study the problem of improved service in both freight and passenger traffic. Although during World War II, labor and materials were not available to continue the rate of progress previously made in improving equipment, we nevertheless continued our studies and designing. At the close of the war, we again began to move forward in the adoption of improved equipment.

Since the war, railroad revenues have decreased so that under present economic conditions drastic economies must be effected in the maintenance of the rolling stock—that is, freight and passenger cars and locomotives; as well as economies in all phases of railroad operation.

Beginning in the early thirties, bus and air competition began to make appreciable inroads on rail passenger traffic. Highway improvements and improved buses, as well as faster airplanes made this competition more serious. To hold the rail traffic, we are building lightweight streamlined passenger cars with improved air-conditioning, reclining seats, better lighting, and easier riding trucks. Such features as pneumatically-operated doors, radios, telephone, better washroom and toilet facilities are also being added.

Similarly, freight cars of all kinds are being redesigned, using welded construction, steel side frames, non-harmonic springs, improved couplers, loading devices, covered hopper cars, and specially designed cars to handle commodities in quantity, the effort being made to obtain the maximum pay-loading per cubical content of car. Freight cars are also being designed and equipped for movement in passenger, express or high-speed arranged freight trains.

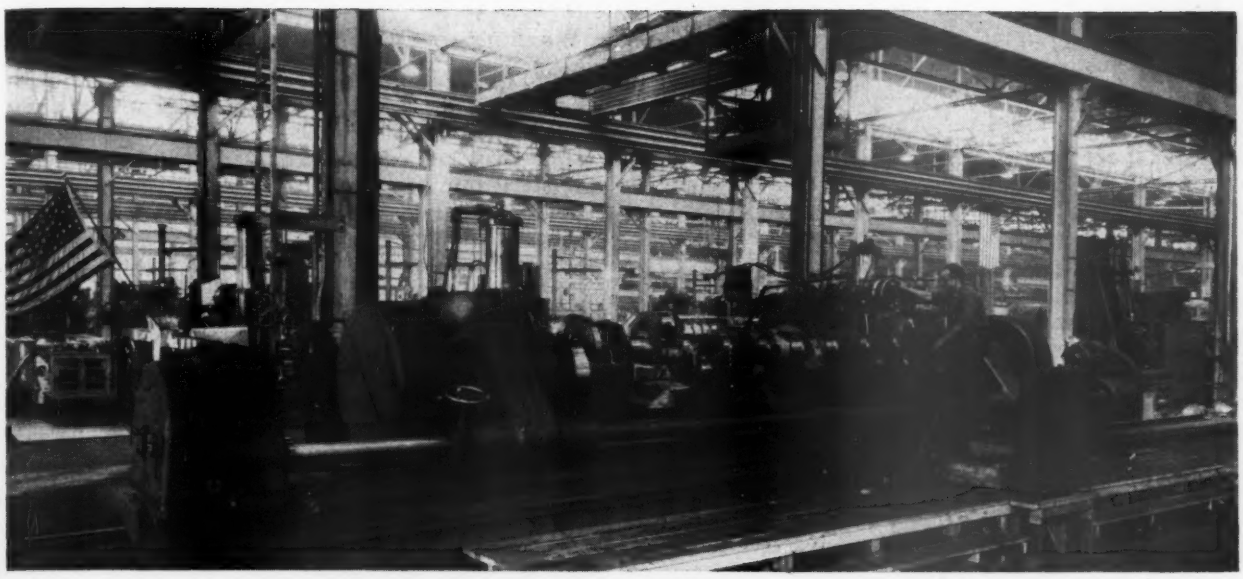
To expedite the handling of traffic, train telephone apparatus has been installed on many passenger and freight locomotives and cabin cars.

With the modernization of car equipment, it necessarily follows that the motive power required to haul this equipment is being designed to handle longer trains of greater tonnage at higher speeds. Four-cylinder, rigid frame locomotives have been built with feedwater heaters, circulating tubes, roller bearings, boosters, high pressure steam boilers, and many other innovations. Locomotives are being designed for solid as well as liquid fuel. Electric locomotives are being used where the density of traffic warrants the cost of electrification. The use of Diesel locomotives is coming to the front in rapid strides, and many of the railroads have accelerated the replacement of steam locomotives with this type of equipment for road and shifting purposes.

The new rolling stock being designed to provide the maximum comfort and convenience for the passengers and the most economical handling of freight shipments, involves in its construction the most advanced metallurgical developments, such as:

a. High tensile steels
b. Heat-treated alloy metals for axles and reciprocating parts, etc.
c. Stainless steel passenger cars
d. Heat-treated aluminum and aluminum extrusions
e. Anti-friction or roller bearings for freight and passenger cars and locomotives
f. Nickel steel sheets for boilers

* Works Engineer, Pennsylvania Railroad, Altoona, Pa.



g. Case-hardening and nitriding of bearing surfaces, etc.

The use of these modern materials involves a new technique insofar as the production and machining of the details are concerned, and as a result the present machine tools must be modernized or replaced with machines having the necessary speeds, feeds and horsepower to permit the use of highspeed steels or cemented tungsten carbide cutting tools.

In addition to the cost of maintaining the new rolling stock, due to the modernization program, there are many other factors that are entering maintenance costs, such as:

a. Increased labor and material costs
b. Health and welfare programs
c. Social security and retirement taxes.

To meet some of these increased maintenance costs, it has become necessary for the railroads to modernize their old machine tools or to purchase new tools, so that the maximum output can be obtained from the machines in question for each man-hour expended.

What Modernization Entails

In analyzing the efficiency of shop facilities, the following factors should be given consideration. A careful study should be made of the buildings used for making repairs to rolling stock, as well as the material-handling and machine tool facilities. The shop buildings should be kept in repair, and have good floors and roofs, proper ventilation and welfare facilities, and modern lighting. The painting of the interior of the shop, using color harmonics, has a very decided influence on the morale of the men at work, and will tend to reduce personal injuries.

The material-handling machinery such as jib cranes and overhead cranes should be carefully surveyed. Many of the overhead cranes in railroad shops today are of old design, have slow-speed motors, old style contactors, and are cage-operated. It is possible to increase the speed and decrease the maintenance cost of such cranes by applying modern motors and controllers, using modern dynamic or hydraulic braking; and the conversion of cranes from the cage-operated to floor-operated type may be highly desirable. Jib cranes with old style cylinder pneumatic hoists, which are erratic in their operation, should be replaced with small electric monorail hoists to facilitate the handling of material in and out of the machines, and to and from trailers at point of storage. Modern machinery, powered either by oil drive, magnetic or electronic control, is being designed for conveyor, slip hoist or other specialized handling devices to permit material to flow through the machine with a minimum of handling.

A careful review should be made of machine tools used in the various operations to determine whether or not the tools are in the right location to reduce handling costs to a minimum. In many of the small railroad shops compressed air for operating pneumatic tools, etc., is obtained by the use of standard steam locomotive air compressors. Considerable economy could be effected by the installation of small electrically-driven air compressors at such locations. A program should be initiated to eliminate line-shafting and belts which are inefficient, hazardous and costly to maintain.

Selection of Motors

In motorizing individual machine tools, consideration should be given as to whether the design of the tool is such that it would permit increasing the speeds and feeds to employ modern cutting steels or cemented tungsten carbide tools. Many of the older machine tools used on the railroads were not built with the idea of conserving material, a large bearing and shaft being employed in the design, and therefore their speeds and feeds can be materially increased. The electronic adjustable speed drive can be very satisfactorily employed for this purpose.

There are many large tools, such as planers, shapers and engine lathes whose efficiency can be considerably increased by the addition of auxiliary motor-driven heads and attachments. Motorized grinding, milling, and drilling heads can be applied to these

larger machines to materially reduce the set-up time of the pieces being machined, eliminating the transporting of material from one machine to another for the several operations.

Power Factor and Motor Control

In motorizing machine tools, consideration should be given to the power factor conditions which will obtain during the duty cycle of the machine, and, if necessary, suitable power factor improvement apparatus should be installed to eliminate power factor penalties imposed by most public utilities and to improve the overall economy of the electrical system.

In selecting the motor control apparatus, due consideration should be given to affording protection against heavy overloads, single phasing, low voltage, or other local faults, to the end that the motor and control apparatus will be protected and any local disturbances will not be transferred to the rest of the electrical system, resulting in possible shutdown of the shops.

Magnetic or air-operated chucks will pay very substantial dividends Electro-hydraulic drives and profiling attachments may be applied to some of the larger machines with equally satisfactory results. Many heavy machine tools are being used for repairing steam locomotives which will not be required after the program of Dieselization has been completed. But as long as there are any steam engines in service, driving wheel lathes, quartering machines and heavy axle lathes will be required, and the modernization or motorization of these machines should be considered.

X-ray Testing

The new design of rolling stock, as previously mentioned, employs many new auxiliaries and accessories. The maintenance and machining of these details will necessitate the purchase of modern machine tools. Many large and small details must be dynamically balanced to eliminate unnecessary wear and vibration.

The use of X-ray and magnetic particle testing discloses effects that may cause serious damage if permitted to pass into the assembly process. The X-ray is also being used for the non-destructive examination of steel and non-ferrous castings to determine whether blow-holes or other imperfections exist as a result of improper design, gating, or temperature in the metal poured. Another satisfactory use of the X-ray is in examining test pieces made by welders so that they may qualify as welders, and more especially as A.S.M.E. welders.

Electric timing devices are being used in connection with the spot welding of passenger cars; positioning machines for the production of weldments; submerged arc welding on freight and passenger car construction. High-speed mechanical presses, with power conveyors, feed material to and from the press, the flow of material being controlled by the electric eye. Grinding machines capable of producing superfinishes are now being required. High-speed multiple automatic machines are justifiable where volume production of details warrants. Modern milling machines with multiple milling heads will effect considerable economies.

Working to Close Tolerances

Modern upsetting and forging machines are needed for the production of steel forgings within closer tolerances of plus or minus two or three-thousandths of an inch, so that the finishing operation may be completed on heavy duty grinding machines. Induction heating or deep-freeze operations are now being employed by the railroads for heat treatment of repair parts. Thread grinders are being used for grinding threads where high tensile strength is required, to eliminate the possibility of fracture due to incipient cracks.

Streamlined passenger trains are now being operated at speeds which necessitate the most accurate machining and balancing of passenger car wheels. Perfectly balanced wheels reduce to a minimum the vibration transferred to the car bodies, and improve materially the riding qualities of the trains.

Most car wheel shops are in need of modern axle producing facilities, such as:

a. Engine lathes, with one or more heads on the carriage, equipped with tracer control

b. Self-contained hydraulic wheel presses of greater capacity, for mounting and dismantling operations

c. Heavy-duty grinders for grinding treads and flanges of car wheels

d. Broaching and milling machines for car wheel brasses, or journal bearings

e. A combination of electric furnace and permanent moulding machines, which have been most successful in producing car wheel brasses of greater uniformity which are free from segregation and blowholes

f. Induction heating for the removal of roller bearing bushings

g. Heavy car wheel lathes, with increased feeds and speeds, to permit of use of cemented tungsten carbide cutting tools.

A new development in the construction of the car wheel lathe enables the profiling of the flange, and as a result, reduces to a minimum the amount of service metal removed from the tread of the wheel.

New Diesel Shop Requirements

Some of the Diesel repair shops are provided with air-conditioning and precipitrons, so that the repair work can be processed under constant temperature and in a clean atmosphere. Among the tools which will be required for this operation are dynamic balancers of sufficient size to take approximately 20 ft. between centers and a swing of 48 in. While the weight of the largest crankshaft now in service is approximately 5,000 lb., future machines should be designed to accurately balance within 20 to 25 in.-lb. crankshafts weighing 7,500 lb. Similarly, the crankshaft grinder must be capable of grinding not only the main bearings but the crankshaft bearings, obtaining a superfinish of 2 to 6 micro-inches r.m.s. Crankshafts now in service are made of steel forgings, special cast iron and cast steel, and grinders should be designed for these materials. Large drilling and boring machines will be required for the machining of the Diesel "A" frames as well as the traction motor cases. Electric bake ovens, seasoning

(*Continued on page 750*)

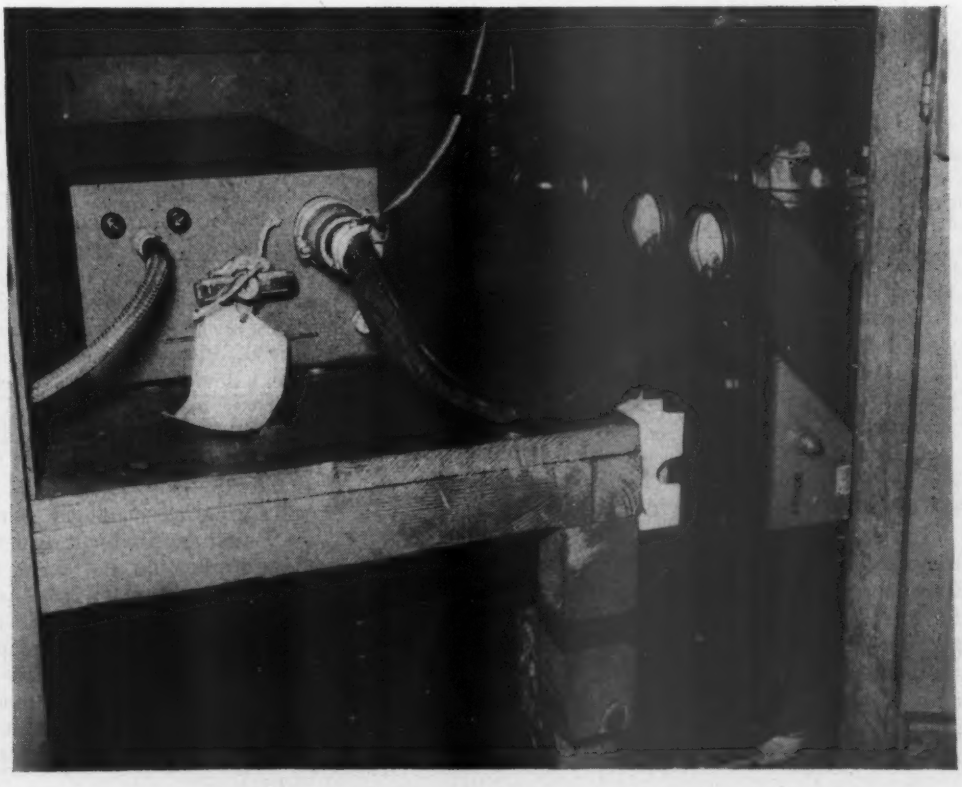
Air-Driven Caboose Generators

Tests being conducted by the Rock Island indicate that devices of this kind may meet operating requirements

THE Chicago, Rock Island and Pacific is experimenting with the potentialities of supplying train communication power on cabooses from generators driven by air motors. For this purpose, the railroad has installed a Chicago Pneumatic Tool Company unit which consists of a vane or rotor-type air motor directly connected to a Leece-Neville alternator. The output of the alternator is passed through a rectifier to produce 7-volt d.c. power.

Under test, the unit consumed 16 cu. ft. of air per minute to produce an electrical output of 20 amp. at 7 volts. The air pressure was 70 lb. per sq. in. and the air was fed to the motor through a 1/8-in. orifice. To prevent interference with car air brake operation, the air is taken from the trainline through a standard air brake cut-off cock followed by a combination check valve and strainer and thence through a 3/16-in. orifice plate into a reservoir approximately 12 in. in diameter and 8 in. long. Air from this reservoir is taken to the air motor through a pipe in which there is a 1/8-in. orifice plate, an automatic air valve and an oil lubricator.

The automatic air valve is set to open the flow of air to the motor at a pressure of 65 lb. per sq. in., and to shut off the flow of air to the motor at 62 lb. per sq. in. The 3/16-in. orifice between the trainline and the reservoir limits the flow of air from the trainline and the 1/8-in. orifice, in the line between the reservoir and the motor, limits the flow of air to the motor, thus it is impossible to have a condition in which the air drawn from the trainline would ever be more than that escaping through an average trainline leak. The automatic air valve which prevents operation of the motor at pressures below 62 lb. per sq. in., gives assurance



Front of the panel showing air connection, meters, radio equipment box on the bench and battery underneath — This equipment is now being "packaged" to provide for easy installation and maintenance

Equipment used on caboose for making tests —The air connection to the motor with gauge and lubricators is shown at the top, the air-motor-driven generators at the bottom and the rectifier on the back of the panel at the left

that there will be no drawing off of air from the trainline when the air pressure falls to a point where application of brakes may result.

There is also a pressure switch operated by the air pressure in the air line leading to the motor. This disconnects the generator from the battery whenever the air pressure falls to that point at which the air motor is stopped.

The generator is a 3-phase, variable frequency alternator which receives its excitation from the battery. The rectifier is of the dry plate type unit which provides 3-phase, full-wave rectification through the operating range.

Voltage and current output of the generator are controlled by a voltage regulator of automotive type and a load limiting element. The voltage regulator controls the amount of resistance inserted in series with the rotor field coil. The load limitor is actuated by a series winding which inserts resistance in the field circuit when the output current reaches a predetermined value.

A 100-amp.-hr. battery, which is charged by the generator, supplies power for operating the radio set when the generator is not running.

The caboose is equipped with two-way radio communication equipment which requires 10 amp. at 6 volts for standby power, and 20 amp. at 6 volts for transmitting. In all cases, under normal conditions, the generator capacity was sufficient to keep the battery fully charged. In actual service on trains of one to fifty cars, there was no noticeable change in trainline pressure when the air-driven generator was in operation.

Electrification of Machine Tools

(*Continued from page 748*)

stands, engine lathes, and degreasers also will be involved in the repairing and maintenance of traction motors and other electrical accessories.

With the increased cost of labor, machine tools should be designed to reduce the set-up time to a minimum, and the electric eye with plastic templates may be used to control the entire machining cycle. In this connection also, the installation of horsepower-hour meters and recording apparatus on production machines will indicate whether or not the machines are being used to maximum capacity through a given tour of duty. Modern machines should be equipped with a device to indicate whether the cutting tools are properly ground, and when they become dull, give the supervision some indication, either by lighting a light or ringing a bell, that they are not performing efficiently.

Railroad management today is studying very carefully each development of new materials to determine their application so far as railroad construction is concerned. Similarly, the latest type machine tools developed by the machine tool industry are being investigated as to their adaptability for the maintenance of rolling stock, etc. Management definitely recognizes the fact that modern machine tools are necessary to reduce to a minimum the cost of maintaining locomotives and cars.

Electric Heating and Welding

This report which is a veritable handbook on the subject was presented at the September meeting of the Electrical Section, Engineering Division, A.A.R.

The report consists of a comprehensive yet concise outline of the potentialities of electric heating and its present status in industry. It is printed herewith in full as follows:

Electricity is not always an economical source of heat. Basically, it is expensive. One kw.h. is equivalent to 2,655,200 ft.-lb. of work, or 3,412 B.t.u. A kw. h. may cost from $0.005 to $0.50. This number of B.t.u. based on the heating value of fuel might cost as follows:

Coal at 13,000 B.t.u. per lb. and $7.00 per ton.... $0.000918
Fuel oil, Bunker C or No. 6 at 19,000 B.t.u. per lb. and $0.04 per gal. 0.000898
Furnace oil No. 2 at 19,320 B.t.u. per lb. and $0.12 per gal. 0.00302
Natural gas at 1,000 B.t.u. per cu. ft. and $0.20 per 1,000 cu. ft. 0.000682

In some cases there are factors which result in overall economy. Control of temperature is relatively quick, simple, and accurate. A wide range of temperature requirements may be met. In some cases the temperature is so high, no other method of application is available. The ease with which heat can be electrically applied to a small restricted location frequently makes it particularly desirable. The ease with which heat may be applied quickly and the use of energy as quickly discontinued when not needed, may result in a high utilization efficiency. This may mean overall economy despite the higher cost equated on a B.t.u. basis.

In some applications it is possible to apply heat with substantial uniformity throughout the cross section of the stock. Time being of such importance today, the speed with which heating to the center can be effected as compared with the method of externally heating and letting the heat "soak in," may make electric heating cheaper.

The development in control equipment makes it possible to apply and control the heating process from a remote location or automatically.

The greater possibility of confining the heat to the restricted location permits cooler and more comfortable working conditions in close proximity to the operation.

Particularly in low temperature requirements, relative freedom from fire hazards is possible.

Many of the applications are particularly suitable for manufacturing processes; however, the national industrial organization is such that when the quantity of an item needed is sufficient to warrant a manufacturing set-up, the work is usually performed by a manufacturing firm rather than by a railroad.

The purpose of this review is to cover the subject in a general way, touching on railroad applications and pointing out other possibilities and limitations.

Direct Application

In direct application the stock to be heated becomes part of the circuit by connection to the power circuit at the ends of the portion to be heated. The heat is then generated by I^2R losses.

A simple example is the thawing of water pipes by current furnished from a welding machine or other source of high-current, low-voltage electric energy. Table 1 furnishes some idea of the current values required.

Another example is the heating of rivets. In this case, the rivet is clamped by terminals pressed against its ends. A special transformer furnishes the high current necessary to heat the rivet to the required "cherry red." Some idea of the current required can be gained from Table II.

The term thermal pliers designates a device which is particularly handy for soldering and brazing pig-tailed wires. Two carbon blocks form the terminals of a transformer secondary. The part to be heated is squeezed between the blocks. Considerable heat is generated at the points of contact and part of the heat is supplied from the heated portion of the carbon blocks.

Low Temperature Applications

An application of low temperature requirement is the use of a lead-covered heating element in wire or cable form buried in the soil to accelerate plant growth. The railroads are not particularly interested.

The same general type of material is also used to keep ice melted in the valleys and on eaves of roofs. This is said to be effective in preventing damage from leaks caused when ice in the valley beyond the building forms a dam and impounds melted snow and ice over the heated building. The same material is wrapped around water pipes to prevent freezing and placed beneath coal hoppers for the same purpose.

Space or comfort heating calls for a relatively low temper-

TABLE I.—POWER REQUIREMENTS FOR THAWING FROZEN WATER PIPES

Pipe Diameter (in in.)	*Practical Current Value*	*Approximate Time to Thaw (min.)*
¼	75	15
½	125	20
¾	200	20
1	250	30
1½	300	30
2	350	40
4	600	75
6	800	120

TABLE II.—POWER REQUIREMENTS FOR ELECTRIC RIVET HEATERS

Rivet Size	*Number of Electrodes*	*Max. Current on 220 Volts*	*Operating Current on 220 Volts*	*Nominal kw.*
¼ in. to ⅝ in. dia.				
Length to 5 in.	2	75	40	9
"	4	100	55	12
⅝ in. to 1 in. dia.				
Length to 7¾ in.	2	125	60	13
"	5	250	100	22
¾ in. to 1¾ in. dia.				
Length to 9 in.	3	250	100	22
"	5	450	175	40

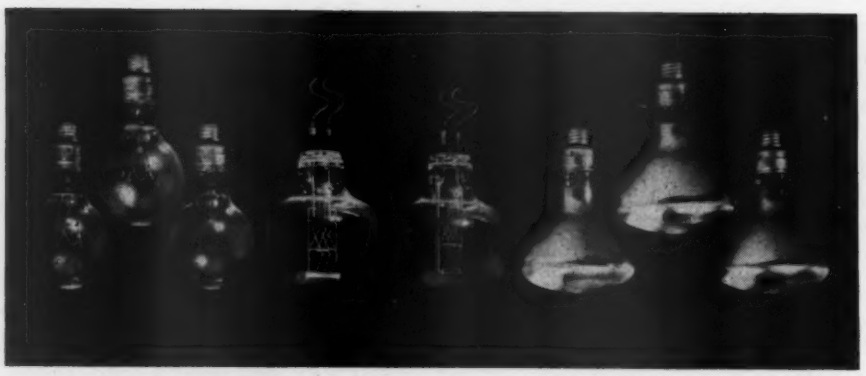


Fig. 1—Standard infrared lamps — Wattage rating and globe designations of the lamps are as follows from left to right: 125, R-40; 250, R-40; 375, R-40; 500, T-40; 1,000, T-40; 125, G-30; 250, G-30; 375, G-30

Courtesy General Electric Company

ature. As a general rule and for large volumes, it is seldom economical. One southern railroad limits this type of heating to the cabs of turntables and of overhead cranes.

In this classification are included the various immersion, pot, and strap-on types used for heating liquids and solids. The heating element may take several forms. The strip and immersion types are familiar. Again it may be as simple as a light globe placed under a small quantity of welding electrodes to keep them dry in a moist climate. The lead covered elements mentioned above may be used. Oil is frequently heated by one of these methods to keep it at a usable viscosity.

Soldering irons and pot heaters for glue, lead, and solder are frequently used by railroads. One railroad reports an increasing use of electric water heaters.

The use of tubular heaters for protecting track switches from becoming inoperative from ice would be considered under this heading. This is strictly a railroad application.

Ovens

Insulation baking ovens are in common use by railroads. They are of the convection type, using ribbon or strip types of heaters. Because fumes are released from the solvent of the varnish, it is necessary to provide means for exhausting them. The proper design must supply sufficient heat to provide for that lost in the exhaust, as well as for heating the work and for radiation loss. An example of the effect of these factors is shown in the appendix. Maximum temperature capacities range from 250 to 500 deg. F.

Radiant or Infrared Heat

In radiant or infrared heating the heat usually originates in glass-enclosed filament lamps of 125, 250, 375, 500, or 1,000 watts rating. These are shown in Fig. 1. Reflectors are provided to help direct the heat to the work. They may be either integral with the globe or part of the fixture.

At least one firm offers a long tube type element with a reflector in an arrangement similar to an industrial fluorescent lighting fixture. This device is shown in Fig. 2.

In infrared heating, the heat goes direct from the heater to the work without appreciable loss through the intermediate air. Essentially the heat is applied at or near the surface of the object. Any depth penetration is obtained by conduction or by the heat "soaking in."

In the event the stock contains parts upon which the infrared rays do not strike directly, this type of heating may still be of advantage due to the more rapid rate of heat transfer into the stock as compared to the convection method.

This type of heating is well suited for conveyor line op-

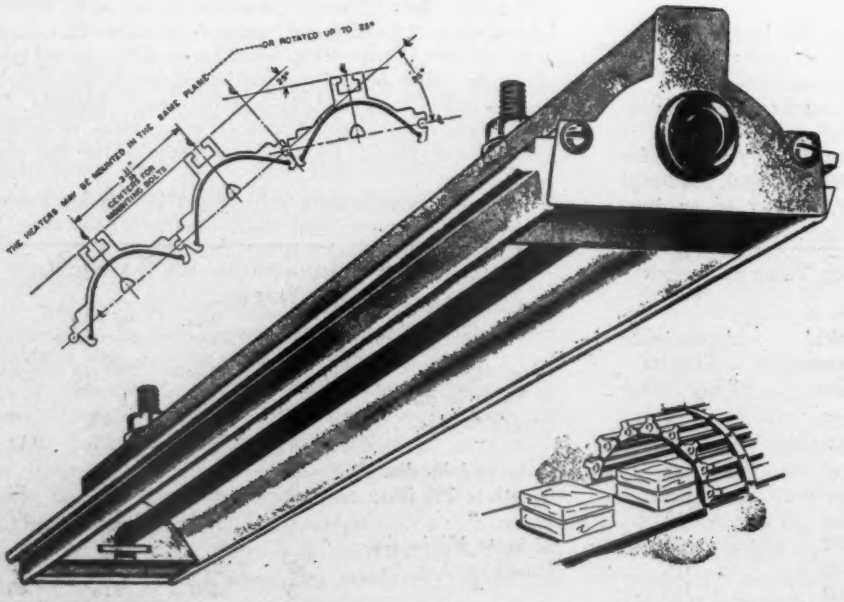


Fig. 2—Open element infrared heater

Courtesy E. L. Wiegand Company

erations and there are many manufacturing applications for curing of surface coatings. Batch type oven and portable units are also well known. Some railroads are using this means of heating for baking of insulation varnishes on windings.

Induction

A review of some definitions is suggested.

High Frequency Heating.—Heating using a frequency of 180 cycles up. The upper range may be placed at about 100 mc.

Radio Frequency Heating.—Heating using a frequency also used in radio work. Roughly this would be in the range of 200 kc. to 100 mc.

Inductive Heating.—Heating of a material classed as a conductor when placed in an alternating magnetic field. The practical limits are in the nature of 25 or 60 cycles to 375 kc.

Dielectric Heating.—Heating of a nonconductor when placed in an electric field. Experimental work is said to be in progress on frequencies up to 600 mc.

In heating inductively, the alternating magnetic flux produces a linking current in the conducting material to be heated. Current passing through resistance generates the heat. It is clear then that the heat will depend on the specific resistance and the amount of the current. Also the current will depend on the cross section area and configuration at right angles to the flux. Further, the flux will depend on the strength of the flux generator and the method of application.

If the stock to be heated is magnetic steel, the factor of permeability is important. For instance, a steel which has a permeability of 250 at room temperature will drop to 1 at about 1,400 deg. F.

Another interesting factor is frequency. With higher frequencies skin effect causes currents to flow or be concentrated in the surface of the conductor. The choice of frequencies makes it possible to vary the heating from approximately uniform over the cross section to heating of the surface only.

The common type of flux generator is an applicator coil of one or more turns in a manner which sends the flux into the stock. The stock may be passed through the coil or placed near the coil. It is easily seen how this fits into a high speed production line manufacturing operation. The cost of the equipment and special fitting necessary still further tends to restrict this type of heating in the higher frequencies to manufacturing plants.

Courtesy Lepel High Frequency Laboratories

Fig. 3—Inductive heating used for curing insulation

Courtesy Raytheon Manufacturing Company

Fig. 4—The Radarange

Common examples in the 60-cycle range used in railroads are inductive heaters for inner races of Hyatt roller bearings, diesel locomotive motor pinions, steam locomotive tires, and crossheads.

Manufacturing plants are using this process for soldering, brazing, annealing, stress relieving, and surface hardening. Stock is also heated for forging. In some cases it is used for inspection. Where conditions are so critical that the process must be carried on in a vacuum, the inductive method furnishes a way of heating.

An interesting application of inductive heating in the curing of insulation on stator windings is shown in Fig. 3.

Dielectric

Materials classed as insulators are frequently poor conductors of heat and the length of time required to heat to the center of the stock is an important factor. Dielectric heating on the other hand is particularly suited for this work in that heat is developed in the center of the stock as well as at the surface.

Even when considering insulators, one must bear in mind that there is no perfect insulator and when a voltage is applied a current will flow. The choice is made of relatively high voltages and frequencies which will produce currents sufficient to heat the stock by the I^2R effect.

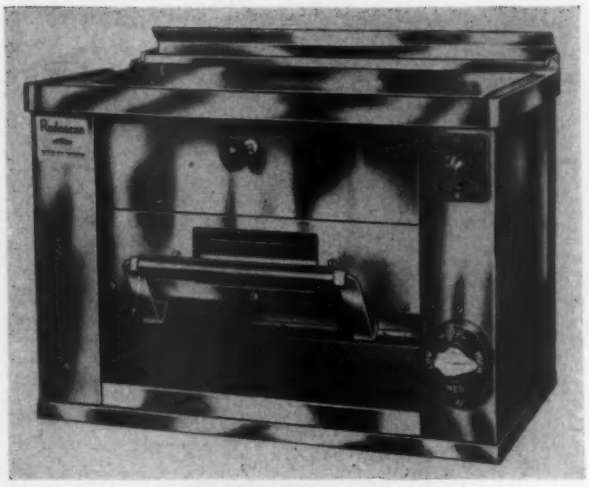
The voltage is applied through electrodes which are plate or sheet terminals between which the stock is placed. It is interesting to note that the combination of an insulator between two plates constitutes a condenser. From this it can be expected that the characteristics as a condenser will have a bearing on the current induced, the current depending on the dimensions and dielectric constant of the stock, the voltage, and the frequency.

Some typical applications are:

Heating of glue between plies of wood in making panels.

Thermal curing of plastics and resins. This may take the form of impregnations in wood or other material, or the material to be cured may be used alone to fill a mold.

Sealing or tacking of sheet plastic is another form of this application.



Courtesy Raytheon Manufacturing Company

Fig. 5—The Radasear searing unit

In general it is seen that for most industrial uses this process belongs to manufacturing rather than railroad maintenance. However, an additional application for this type of heating is developing in the preparation of food. Figs. 4 and 5 show equipment for this purpose.

Welding and Related Processes

Considered under this heading are welding and cutting methods with applications of electrical energy to produce heat sufficient to cause fusion of metals such as those in the range of aluminum and steel.

Resistance Welding.—This type of welding is usually known by more familiar designations such as butt welding or spot welding.

In this general process two pieces of metal are pressed together and a heavy current passed through the contact areas. The relatively higher resistance at the contact zone causes localized heating with fusion of the metal. Sufficient pressure is applied and the welded parts allowed to cool before pressure is released.

The railroad industry uses both butt and spot welding.

The butt welding of steam locomotive boiler flues is a popular railroad application. A considerable number of installations have been made of butt welded track rails. These are fabricated into long continuous lengths on a patent and contract basis.

In spot welding, two sheets of metal are pressed together between electrodes of limited area. The passing of high current causes a welding of the two sheets in an area approaching the cross section of the electrode tips. The railroads make use of spot welding in the fabrication of jackets for steam locomotive boilers and in the fabrication of some miscellaneous sheet metal assemblies.

In the earlier use of spot welding, dependence was placed in the skill of the operator to time the heating, pressure, and cooling. The time intervals are small and it has been found that the job of timing can be done much more accurately by electronic means.

Seam welding is a special application of spot welding in which the electrodes are in the form of rollers and the weld is made continuous rather than at intervals.

Stud welding produces a stud welded to a plate. This combines features oc both spot and butt welding. It was used extensively in ship building but would apparently not be permitted on railroad rolling stock.

Arc Welding.—The use of arc welding by railroads in buildings, bridges, and rolling stock is too well known to warrant any basic description. One of the points of interest in this connection is the continued increase in use of a.c. as compared to d.c. On one railroad where most of the equipment is a.c. and all a.c. units are equipped with open circuit voltage reducing control, there were complaints of shocks at one location that presented humid conditions, such shocks being felt on d.c. units, whereas none were felt on the a.c. units.

The submerged arc process is being used to an increased extent. As an automatic machine it was more particularly a manufacturing device; however, with the introduction of the manual adaptation, it becomes a tool suitable to railroad needs.

As a means of shielding the welding process from the air, the inert gas process was developed. In addition to its application to mild steel, it is used for magnesium, aluminum, and copper alloys, stainless steels, monel, and inconel. The method features a tungsten or carbon electrode with an arc produced inside an inert gas envelope of argon or helium.

One of the developments along this line recently released is the gas-shielded arc spot welding process. It can be used as a portable arrangement. Its present field of application is to sheets up to approximately $\frac{1}{16}$ in. thick. It may be used for spot welding two sheets together or one sheet to a heavier metal frame.

Arc Cutting.—At one time considerable was written about the use of the electric arc for cutting steel plates and scrap. The acetylene torch has taken over this work.

Furnaces

Types of Furnaces: Box; Car bottom; Pit; Pot; Salt bath; Lead bath.

Processes: Assaying; Analysis; Heat Treating; Tempering; Drawing; Annealing; Hardening; Normalizing; Carburizing; Cyaniding; Brazing; Melting; Forging; Welding; Sintering; Bluing; Aging; Descaling.

Method of Heating.—The factors of conduction, convection, and radiation may all be present in a furnace. The heat may originate in resistance units, an arc, or in the work stock by induction.

Laboratory Furnaces.—The tube type and the small box type furnaces are probably found in every railroad laboratory. In general they are used in analysis where it is necessary to process the sample at relatively high temperature. These use resistance elements of the wire, ribbon, strip, or globar type. In one case the fullest use is made of radiation by having the inner sides of multiple-reflector shape with

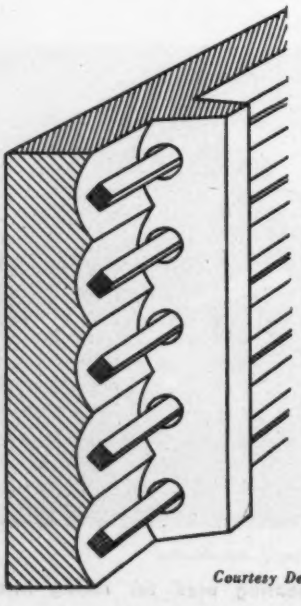
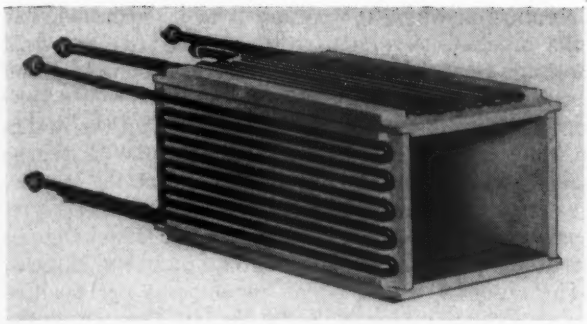


Fig. 6—Fire clay furnace element

Courtesy Denver Fire Clay Furnace Co.



Courtesy Hevi Duty Electric Company

Fig. 7—Muffle of "Hevi Duty" electric furnace

the heating elements in the focal centers, shown in Fig. 6.

Furnaces are offered for operating temperatures up to 2,800 deg. F. One firm offers them for 2,950 deg. F. For the higher temperatures, heating elements may be of silicon carbide rod (globar) or platinum windings. One firm offers a furnace using a winding of platinum-rhodium. For operating temperatures in the range from 1,600 deg. F. to 2,350 deg. F., heating elements of an alloy of chromium-aluminum iron may also be used, in addition to the globar elements. An element of such material, as used in a small box or muffle furnace, is shown in Fig. 7. For temperatures of 2,000 deg. F. or lower, heating elements made of nickel-chromium are most common.

Heat Treating Furnaces.—Electric heat treating furnaces are widely used in larger railroad shops. While some of the work performed approaches a manufacturing set-up, as a general rule, it runs in small lots. The peculiar needs of the individual railroad and the economies to be realized seem to favor the adaptation of these furnaces to a fair volume of work performed by the railroads.

In hardening of tools, particularly those of high alloy and high speed steels, a common set-up consists of three units called preheating, high heating, and drawing.

	Preheat	*High Heat*	*Drawing*
	deg. F.	*deg. F.*	*deg. F.*
Temperature range..	1,400 to 1,500	2,200 to 2,400	300 to 1,200
	deg. F.	*deg. F.*	*deg. F.*

Resistance heating elements are universally used except in the case of some salt baths in which electrodes are immersed. Here the conductivity of the molten salt forms the current path and becomes the heating element. In the general type, the element is of wire, ribbon, or tubular metallic units or, in the higher temperature, of rod made of silicon carbide.

A pot type furnace is shown in Fig. 8.

Induction Furnaces.—This is an application or group of applications of induction heating principles mentioned under an earlier title. The general use in this case is for the melting of metal. The frequency chosen may be as high as 500 kc. The source may be commercial power lines if the frequency is in the 25 to 60-cycle range. Motor generators produce frequencies nominally called 1,000, 3,000, and 10,000 cycles. Mercury arc rectifier type converters usually operate at 800 to 1,500 cycles. Spark gap converters give a range of 10 to 500 kc. In this class the mercury-hydrogen converters operate in the range of 10 to 80 kc. and the quenched gap type in the range of 100 to 500 kc. The vacuum tube generator will produce frequencies from about 200 kc. to many megacycles. However, 500 kc. would probably represent the upper limit desired for melting of metal.

Arc Furnaces.—Arc furnaces are found in the shops of a few railroads that make their own steel castings. This type of furnace may be obtained in capacities rated from 6 to 115 tons of charge.

Arc furnaces develop heat in arcs at the ends of carbon or graphite electrodes almost in contact with the charge. Graphite electrodes may be obtained from 4 to 20 in. in diameter and carbon from 8 to 40 in. in diameter. With graphite a current density of 90 to 110 amp. per sq. in. may be used in the larger sizes. In the smaller sizes this is increased to the range of 140 to 240 amp. per sq. in. With carbon electrodes a current density of 30 to 40 amp. per sq. in. is acceptable. In the smaller sizes this may be increased to a range of 40 to 60 amp. per sq. in.

Power Requirement for Armature Baking Oven

Heat Absorption in Charge.—Assume 600-lb. pay load containing copper, cotton, tape, and varnish with an approximate specific heat of 0.15. Truck of 200 lb. of steel with specific heat of 0.12.

Conventional varnish to be baked at 250 deg. F.

Room temperature 70 deg. F.

Then—

250 deg. — 70 deg. = 180 deg. temperature difference

$600 \times 0.15 \times 180 = 16{,}200$ B.t.u.

$200 \times 0.12 \times 180 = 4{,}300$

To bring charge to 250 deg. requires 20,500 B.t.u.

Radiation.—Assume 4 in. rock wool of 12-lb. density having a factor of 0.35 B.t.u. per sq. ft. per deg. F.

Inside surface of 295 sq. ft.

Then—

$295 \times 0.35 \times 180 = 18{,}600$ B.t.u.

Ventilation.—For batch process ovens, 350 cu. ft. per min. (referred to 70 deg. F.) of fresh air should be furnished for each gallon of flammable volatile introduced.

Assume 1½ gal. varnish containing ¾ gal. solvent.

Then—

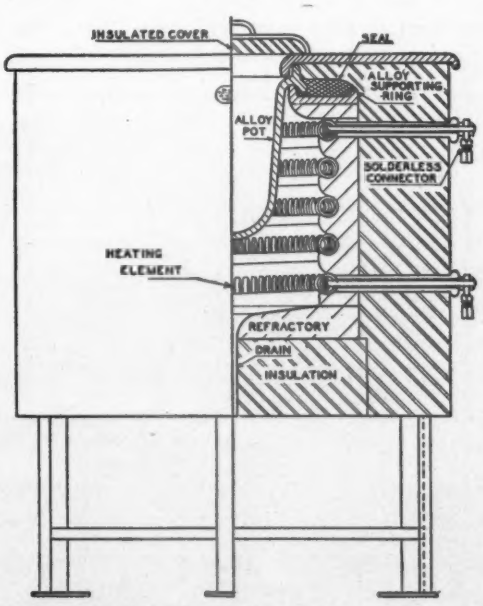
$\frac{3}{4} \times 350 = 264$ cu. ft. per min.

1 cu. ft. air weighs 0.075 lb. and has specific heat of 0.24

$264 \times 60 \times 0.075 \times 0.24 \times 180 = 51{,}320$ B.t.u. per hr.

Total Power Requirement.—Combining these values and applying safety and experience factors with 3,412 B.t.u. equivalent to 1 kw. gives a heat requirement of 30 kw.

The report is signed by C. A. Williamson (*chairman*), electrical engineer, Texas & New Orleans; R. C. Welsh (*vice-chairman*), foreman, office of electrical engineer, Pennsylvania; H. C. Cross, general manager, Baltimore & Ohio Chicago Terminal; E. B. Hager, assistant engineer, Illinois



Courtesy American Electric Furnace Co.

Fig. 8—Pot furnace

Central; F. A. Rogers, engineer, electric lighting and distribution, New York, New Haven & Hartford; C. S. Stringfellow, assistant to electrical engineer, Atlantic Coast Line; A. L. Kelly, electrical engineer, Missouri Pacific; E. H. Werner, assistant electrical engineer, Virginian; and R. P. Winton, testing engineer, Norfolk & Western.

Discussion

The report was presented by Mr. Williamson with some additional information to clarify and supplement the report. Discussion was directed primarily toward possible hazards involved. One member said that when thawing pipes, operators should be warned that precaution must be taken to prevent fires. Another cited a case in which a baking oven blew up. This fortunately happened at night and no one was injured. The incident showed the importance of proper ventilation.

In response to a question concerning the use of infra-red lamps, one member said that manufacturers are now using them for baking surface finishes on Diesel-electric locomotives and that the practice has greatly reduced drying time. Other applications of electric heating included in the discussion were electric welding for building up rail ends, heating of Diesel lubricating oil and radiant space heating. In conclusion, a member complimented the committee on the large amount of useful information contained in the report, saying that it was almost a text book.

How to Select Starting Batteries

By K. A. Vaughan†

The number of lead-acid cells required to operate the motor needed to start a Diesel engine is determined by the designer of the Diesel engine. If, for example, the starting motor of a locomotive Diesel is designed about a 64-volt circuit, a 32-cell lead-acid battery is required, each lead-acid cell being rated at 2 volts.

But there is a lot more to it than that. The three principal considerations involved are: (1) the temperature at which the battery is to be operated, (2) the breakaway voltage required, and (3) the final voltage to which the battery can be discharged and still start the engine.

Knowing these factors (they depend on the design of the engine and starting motor), the discharge characteristic curves are used to select the correct battery. The discharge characteristic curves are prepared on a per cell basis since different Diesel engines require batteries having different numbers of cells. The abscissa is marked off in amperes per positive plate. The reason for this will become apparent as the use of the curves is explained.

Typical curves are shown in Figs. 1 and 2. If an initial breakaway voltage of 1.2 volts per cell is required, one would follow this coordinate out to the "initial volts" curve and then drop down to the "amperes per positive plate" ordinate. Knowing the total current required, say 2,000 amp. for breakaway, the number of positive plates can be determined, in this case $2000/180 = 11.1$, or 12 plates. For each positive plate there is an equal number, plus one, of negative plates. So the battery required would be a 25-plate battery. Battery plates are connected in parallel so the more plates, the more current available. Incidentally, this battery would discharge to a final voltage of .70 volts per cell in 2¼ minutes.

From Fig. 2, if the battery was to be used in a northern climate, a 33-plate battery would be required.

Sometimes the selection of the battery depends on the final voltage, i.e., the voltage to which the battery can be discharged and still start the engine. This value, again, is determined by the design of the starting circuit. For example, if the final voltage of a battery required to deliver 1,200 amp. is not to be below 1.00 volts per cell at 77 deg. F., a 21-plate battery would be required. This battery would have an initial voltage of 1.40 volts per cell and would discharge to a final voltage of 1.00 volts in 4 minutes. At 32 deg. F. a 31-plate battery would be required.

If the battery indicated does not fit the space limitations, then the same procedure would be followed using discharge characteristic curves of other

† Manager, Field Engineering, Gould Storage Battery Corporation, Trenton, N. J.

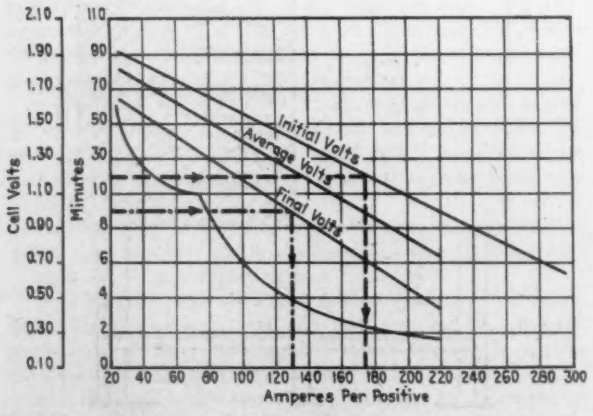


Fig. 1—Discharge characteristics for a starting battery operating at 77 deg. F.

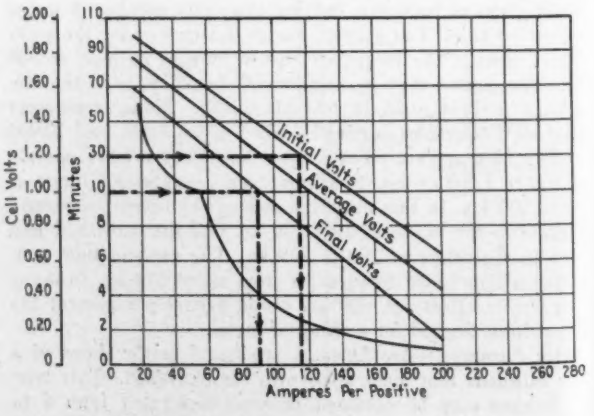


Fig. 2—Discharge characteristics for a battery operating at 32 deg. F.

battery models until a battery fitting the space limitations is met. Because of the size and weight, batteries are assembled in units of three or four cells. This not only makes it easier to handle the batteries in confined spaces, but also makes it possible to stow sections of the battery in several locations. Since cells are connected in series the current remains the same regardless of the number of cells used.

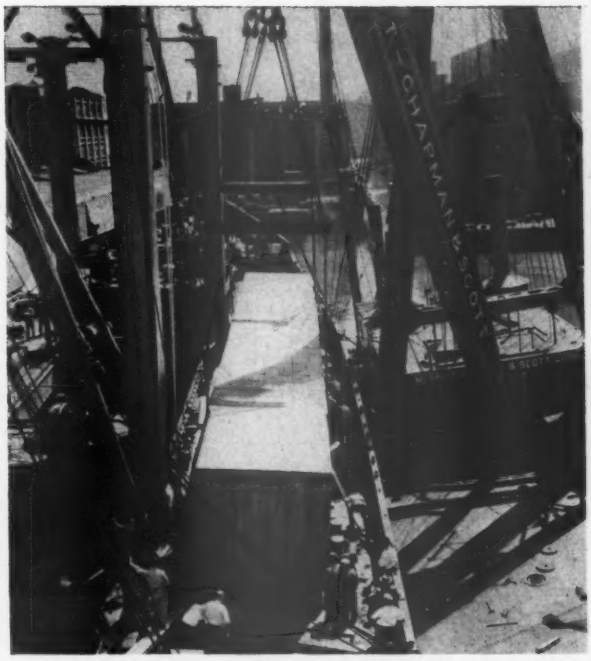
4,000-Hp. Locomotives Go Overseas to Chile

The two largest electric locomotives ever exported by the General Electric Company have started their long trip to Chile, S. A. Each locomotive weighs 230 tons and has a continuous rating of 4,000 hp. at the rails. Operating from a 3,000-volt overhead contact system, they will be used for freight and passenger service on the electrified division of the Chilean State Railways, extending from Valparaiso to Santiago, where connections are made with the Transandean Railway, which handles through traffic to Buenos Aires.

Designed for operation on heavy grades in Chile, the locomotives are able to haul a 990-ton train of 36 cars up a 2.2 per cent grade at 25 m.p.h. Maximum rated speed is 75 m.p.h.

The units have an overall length of 75 ft. 8 in. and have a 66-in. gauge. The first of the units has already been shipped. The second recently left Erie for New York City for early shipment to Chile.

The locomotives were built at the General Electric Company's Erie, Pa., plant, and are so large that when shipment was made, it was necessary to use a special five-car train on circuitous routing. Three of the five cars carried the locomotive cab which overhung the center flat car by almost 15 ft. on either end. The other two flat cars each carried half of the running gear. The sections were boxed for protection against the elements while at sea. Total weight of a locomotive cab and its protective box was 246,900 lb. The trucks were boxed separately. Enough lumber, 15,000 board ft., went into making the box housing the cab, to build six 10-ft. x 12-ft. rooms. More than 246 lb. of nails were used in its construction.



The crate containing the cab being loaded on board the S.S. Copaipo in New York

One of the two electric locomotives shipped from Erie, Pa., to Valparaiso, Chile

NEW DEVICES

Steel-Abrasive Non-Skid Floor Plate

By combining two irreconcilable materials—abrasive grain and rolled steel—a non-skid floor plate has been introduced by the Alan Wood Steel Co., Conshohocken, Pa. This new product is being marketed under the name of A. W. Algrip.

Abrasive grain, the same type used in grinding wheels, is rolled as an integral part of the upper portion of steel floor

plate. It can be sheared, drilled, countersunk, machined and flame-cut. Flanging is not recommended due to the abrasive material being non-elastic.

There are manifold uses for the product in most every industrial plant. It is effective when used for industrial floors, loading platforms and ramps, walkways, building entrances, and for trench and hatch covers.

With the floor plate, there is no slipping even when it is placed on a steep incline. It does not lose its non-slip characteristic, because as the surface wears, new abrasive particles are constantly exposed.

Floor plates are available in thickness from ⅛-in. to ⅜-in. inclusive, and in widths up to 60-in maximum by 144-in. long.

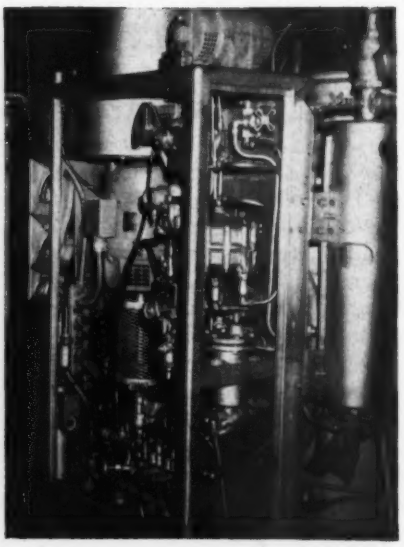
Pressure-Type Welding Improves Boiler Tubing

A new process for welding boiler tubes has been developed by the Combustion Engineering-Superheater, Inc., Chattanooga, Tenn. The principles of induction heating and pressure welding are both employed in the new process which is used to make tube joints. A high-frequency generator supplies power for the induction coil, the heating from which serves in effecting a pressure-type weld. A feature of this apparatus is an enclosed atmosphere to protect the welding surfaces against oxidation during the heating period. By combining induction heating and pressure welding, pressure-type welds may be made without objectionable upsetting of metal in the welding zone.

Tubes, drum hangar rods, and headers may be welded by this process, which is capable of handling materials ranging from 1-in. to 10-in in diameter. Actual welding time is but a few seconds, depending upon the size of material. The use of backing rings is avoided, and welds may be made of one alloy steel to another or of alloy steel to carbon steel.

Vapor-Clarkson 4,000-lb. Steam Generator

The Vapor Heating Corporation, Chicago, has recently developed a larger design of the Intensi-Fired steam generator for Diesel locomotives. The new Model OK-4740 has a rated capacity of 4,000 lb. of steam per hr. with 20 per cent overload capacity, which steps the output up to 4,800 lb. per hr., or more than any steam generator heretofore furnished for heating Diesel-powered passenger trains. The generator occupies a space only 73 in. long, by 50 in. wide, by 79½ in. high.



In addition to exceptional capacity the new steam generator includes an improved coil design, starting switch, blower, firepot, spark plug, Servo-control and electric-eye shut-off. All drive belts are also eliminated.

In order to develop more steam in a machine of the same size as earlier models, Vapor engineers developed a new conical coil, each turn of which has an offset to give maximum exposed surface to hot gases. There are 700 ft. of seamless steel tubing in the coil, or 200 ft. more than in previous designs. Each coil passes a hydrostatic test at 1,200 lb. per sq. in. and meets all boiler-code specifications.

An economizer coil, made of 75 ft. of seamless-steel tubing, has been placed in the path of exhaust gases, resulting in more efficient use of heat released and also reducing to a considerable extent exterior and interior corrosion of the main coil.

A three-phase starting sequence is provided. One switch starts the generator and turns on the one 7½-hp. electric motor which operates the water pump, blower and fuel pump.

In order to move the needed air with strict limitations on space and current

draw it was necessary to develop a more efficient blower fan. Full working steam pressures of over 200 lb. are developed in less than two minutes from water at 50 deg. F.

In line with new Diesel-locomotive developments, all driving belts have been replaced with a new direct drive. This is an added safety step and also makes it unnecessary for railroads to carry additional stocks of belts.

The refractory has been removed from the firepot resulting in larger combustion space to increase the amount of heat released.

A rugged electric eye has been applied as standard equipment on this machine to cut off the fuel supply if the fire does not light up in five seconds, an added safety control.

A new type of flat spark-plug plate has been developed to give more sparking area, more positive lighting up of the fire and to require fewer adjustments.

The Servo-control includes heavier water-body castings to reduce the chance of warpage, an aluminum instead of a brass piston, clock-type spring instead of coil springs, and fewer adjustments. These changes all serve to give better service with less maintenance.

Other engineering improvements include the fuel nozzle, heavier relays, damper position stops, fuel pressure valve, blow-down valves and pressure-gauge snubbers.

Hydraulic Feed-Axle Centering Machine

A hydraulic-feed axle centering machine has been built by the Niles Tool Works Co., Division of Lima-Hamilton Corp., Hamilton, Ohio. The unit is designed for centering new axles, and renewing centers on either mounted or unmounted axles, prior to turning operations. With this machine, too, wheel sets may be checked as to concentricity of journals, with reference to the periphery of the wheel.

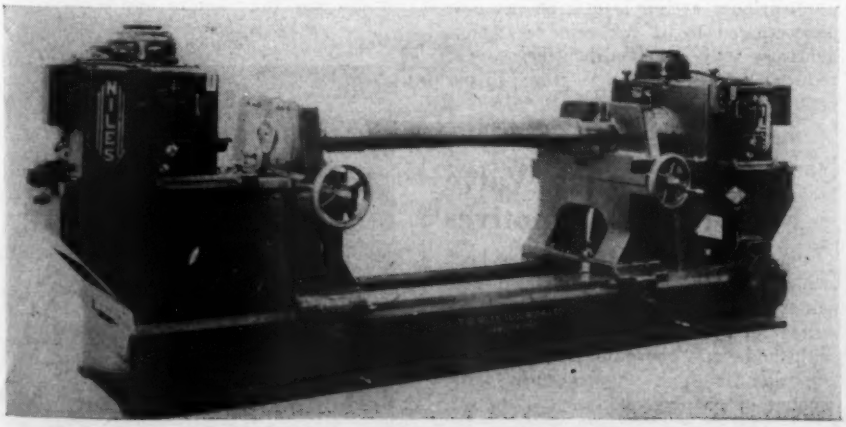
Measuring 15½ ft. long, 6 ft. high, and 3½ ft. wide, the axle centering machine consists of a bed, two sliding spindle heads, and two axle-chucking units. The right-hand head is assembled on a stand that is slidably mounted on the bed and provided with an adjustment for accommodating various lengths of axles. The left-hand head is mounted on a fixed stand, rigidly bolted to the bed. Each spindle is driven through worm reduction gearing by a 3-hp. vertically mounted motor operating at 1,800 r.p.m.

Axles may be chucked on the collar, on the journal, or on the wheel seat. The axle-chucking units are adjustable, with respect to length and diameter, to accommodate various size axles, both mounted and unmounted, with either inside or outside journals. Two sets of jaws to accommodate axle journals 4¼ to 6½ in. diameter, inclusive, are furnished with the machine.

In operation, the fully automatic unit permits a depth of cut of only 1/32-in. or less. By clamping on the journal collar, the new centers coincide with the original center, and therefore axle journals may be trued up with approximately 1/32-in. dept of cut. As a result, it is not necessary to remove the amount of metal that has been previously required under old methods to obtain axles with perfect centers. This feature provides savings in the metal of the axle, itself, so that the axle can be used much longer.

Renewed centers in axles can be machined to within 0.005-in. concentricity with the journals, with better balanced wheels as a consequence.

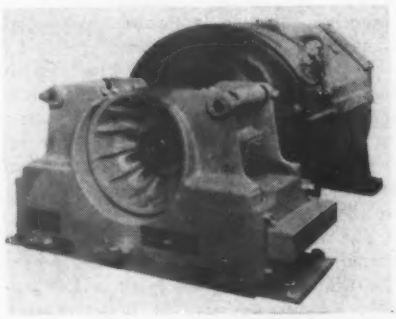
Once the axle has been clamped in the chucking jaws, the only manual operation necessary is moving the hydraulic control lever into the traverse position. From this point on, the operation is entirely automatic. With the spindles revolving, both heads feed forward simultaneously and stop with automatic control when centers are drilled to American Association of Railroads requirements. The heads then return to starting position and so are ready for the next cycle.



Brake and Hoist Control

Two closely related equipments, a d.c. two-shoe, two-magnet brake and a d.c. crane hoist control, have been announced by General Electric's Control Divisions. The brake is designed for use on steel mill drives, cranes, hoists, bridges, conveyors, and for general marine service. The control is specially intended for use on whirley, revolver, gantry, and overhead cranes in steel mills, shipyards, on ore bridges, warehouses, and on loading and unloading towers.

The brake consists of a malleable iron frame, two self-aligning shoes which pivot on spherical bearings, two armatures pivoting on sealed graphite bearings, two



Two-shoe, two-magnet, d.c. brake

symmetrical E-type magnets with cast-in coils, and a ventilated wheel of molybdenum alloy. The iron frame fully protects all moving parts, universal ball joints protected by neoprene sleeves permit self-alignment of shoes and insure uniform lining wear, and a quick-release mechanism, which responds to a wrench, permitting removal of wheel, either horizontally or vertically, or changing brake linings without disassembling any part. The torque-setting indicator gives a direct reading of foot pounds torque setting, and the operating gap indicator provides a ready visual check on magnet gap and lining wear. The brake is applicable for either right- or left-hand mounting, either on the floor or, with brackets, on motors.

The crane hoist control incorporates several unique features. It provides power hoisting and power dynamic lowering, depending upon the requirements of the load on the hook. The change from power to dynamic braking lowering is inherent in the control and hence is independent of either the operator or any particular control device. When decelerating, the speed is reduced automatically before the solenoid brake sets, thus minimizing mechanical brake maintenance and protecting both motors and hoist equipment from excessive wear and shock.

In addition, both overshoot and down drift are eliminated. When the master switch is thrown rapidly from the "off" position to any lowering position, with a

load on the hook, the motor speed does not overshoot; and since the first hoisting point will hold rated load with no downward drift, the master switch need only be moved to the second hoisting point to lift the load.

Futhermore, ample protection is afforded by a spring-closed contactor which provides dynamic braking circuit, thus assuring a retarded lowering speed even if the magnet brake fails to hold an excessive load.

Battery Cell Filler

An improved Exide battery cell-filler is announced by the Electric Storage Battery Company, Philadelphia, Pa. It is adapted to batteries used for railway car lighting and air conditioning, Diesel locomotives, electric industrial trucks and tractors, and marine service.

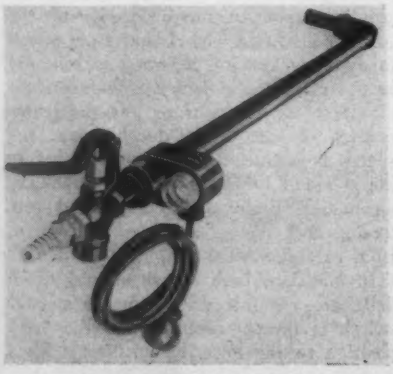
It is made in three sizes: 45-in. length for railway car lighting and air conditioning batteries; 30-in. for Diesel-electric locomotives; and 15-in. for industrial trucks, and certain types of marine batteries. It has been field-tested thoroughly in these services.

The filler consists of a tube with a nozzle at one end and at the other a handle which is equipped with a Lunkenheimer valve, operated by finger control. At the valve or handle end is an electric signal lamp which flashes a warning when the water in the cell reaches the correct level.

The lamp is operated from a 115/6-volt transformer, or from five dry cells, carried in a small steel case attached to a canvas belt, which goes around a maintenance man's waist.

The nozzle is molded of tough rubber to withstand severe operating conditions. The filler is so designed that if, through abnormal service conditions, certain parts are damaged, it may be disassembled and the damaged parts easily repaired or replaced.

One of the accessory features of the filler is a "quick-as-a-wink" disconnect coupling and valve available for cell-fillers used in the railway field where the batteries are located on both sides of the car. This feature enables the maintenance man to disconnect the cell-filler quickly from the water supply hose, which can then be passed under the car while the filler is carried around by hand to the other side, and reconnected.



D.C. Welder Uses Plate-Type Rectifiers

Direct-current welding machines, using plate-type rectifiers instead of the conventional rotating components used in motor-generator welding equipment, are available from the Westinghouse Electric Corporation. These welders are rated in accordance with N.E.M.A. standards for industrial type, single-operator, arc welders. They are available in 200-, 300-, and 400-amp. ratings.

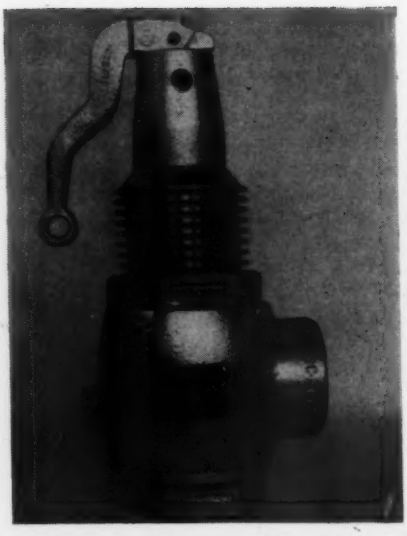
Major components of the welders are a three-phase welding transformer, a

three-phase adjustable reactor, and a plate-type (selenium) three-phase, full-wave rectifier.

The no-load loss in a 300-amp. welder is 500 watts, as compared to 2,480 to 3,600 watts for a conventional motor-generator welder. The power factor at normal operating load conditions is comparable to induction-motor-driven welders. The welder's efficiency at full load is 66 per cent as compared to 54 per cent for motor-generator welders. Efficiency increases at reduced load conditions, reaching 73 per cent at 20 per cent rated load.

Safety Valve For Diesel Locomotives

A newly designed safety valve has been made expressly for use on steam generators on Diesel locomotives. It is suited for use where a safety valve must withstand an "above-the-average" beating due to high temperatures, large amount of popping, etc.



Every part of this valve distributed by the Magnus Brass Mfg. Co., Cincinnati 2, Ohio, has been engineered and tested to secure the right combination of designs and materials. The result is the Type IV safety valve, which has a silver nickel alloy feather valve and base; an extremely hard bronze alloy adjusting ring; a special spring made of nickel alloy which will permit setting for either a 245-lb. or 300-lb. steam generator pressure with no change of any parts.

The spring case has been serrated to dissipate heat to give an accurate, rugged safety valve for long, hard use.

Heavy-Duty Floodlights

Two heavy-duty, general-purpose floodlights, have been announced by General Electric's Lighting and Rectifier Divisions.

The new lights, the type L-84 rated at 500 watts and the type L-85 rated 1,000 watts, can be used for all general-purpose applications and are available for either general lighting service or floodlighting service lamps. A complete range of N.E.M.A. types 1 through 5 is provided.

Weather-tight and substantially constructed of heavy-gauge aluminum, each of the new units weighs less than 17 lb.

SAVE SAFELY

WITH

Chilled Car Wheels

Chilled Car Wheels give you immediate savings in three big ways:

- **LOWER FIRST COST!**
- **LESS INVENTORY REQUIREMENTS!**
- **REDUCED REPLACEMENT AND WHEEL SHOP COSTS!**

Add to these economies the greater safety record of Chilled Car Wheels and you have a combination of advantages you can't afford to overlook.

IMPROVED SAFETY—The safety record of wheels made at AMCCW plants has steadily improved, the last five years having a better average record than any previous such period. The record for the first half of 1949 was still better and actually shows a 75% improvement over the average of the same periods in the previous five years.

AMCCW

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

445 NORTH SACRAMENTO BOULEVARD, CHICAGO 12, ILL.

American Car & Foundry Co. • Canadian Car & Foundry Co. • Griffin Wheel Co.
Marshall Car Wheel & Foundry Co. • New York Car Wheel Co. • Pullman-Standard Car Mfg. Co.
Southern Wheel Co. • Standard Steel Works • Wheel and Brake Shoe Co.

Non-corrosive materials—aluminum and stainless steel—are used throughout.

The door, hinged for easy relamping, uses three simple swing-type door latches. The heat-resistant door glass is cushioned in a silicone rubber gasket which wraps around the edge of the glass and also seals the joint between the door and the casing. A clamping handle for vertical adjustments is provided so that the floodlights can be serviced completely without the use of tools.

An auxiliary reflector of finished aluminum provides high beam efficiency. The floodlights can be provided with either narrow-beam polished or wide-beam etched reflectors.

Both types are available in three standard mountings, including a portable base.

Tool for Removing Anchor Plates

A new tool for fast, easy and clean removal of strap ends, anchor plates, etc., in cleaning freight cars is now available from Signode Steel Strapping Company,

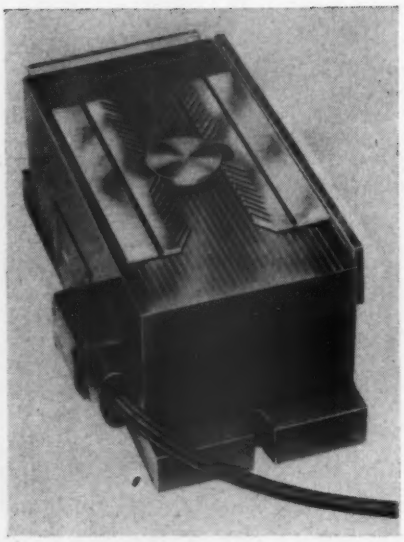
Chicago. It consists of a patented bar with a ratchet head and a handy pry-bar end. It is 36½ in. in length, and light, weighing only 6¾ lbs.

Hitherto, cleaning up freight cars has been a difficult task. This ratchet tool draws out the nails as it lifts the plate with minimum effort. There is no splintering of wood on either the car side walls or the floor. Where the stub ends of the strap are short, they can be easily and quickly removed with the pry-bar end.

Magnetically Actuated Clamping Device

The illustrated "Magna-Vise" consists of a pair of magnetically actuated clamps so designed that work parts of non-magnetic materials may be located between the jaws and held firmly against the face of the magnetic chuck for machining purposes.

The unit, manufactured by Hanchett Magna-Lock Corp., Big Rapids, Mich., increases the usefulness of magnetic chucking equipment by making it applicable to hold rigid types of non-magnetic material such as brass, copper,



plastic, glass, hard rubber, aluminum, stainless steel, etc.

The work is placed on the magnetic chuck surface between the clamps so that the toothed edge of each clamp is in contact with the work.

Each clamp is composed of two steel sections connected to each other by a pre-set spring steel strip. The angle of this spring is such that these sections normally will be 5 deg. to each other. When the chuck is energized, the jaws of the clamps are forcibly drawn to a horizontal position by the magnet, exerting a powerful lateral thrust against the work piece.

Saddle-Type Universal Turret Lathe

Illustrated here is a redesigned lathe, with 2½-in. bar and 12-in. chuck capacity, weighing over 4½ tons without tooling. It combines many construction and control features, characteristic of the previous model, with improvements designed to provide rapid metal removal.

The new over-all functional design of the Model 7A universal turret lathe produced by the Jones & Lamson Machine Co., Springfield, Vt., gives consideration to the greatly accelerated developments in high surface speed metal removal. The design of the bed, emphasizes strength and rigidity, and provides for increased facility in chip disposal.

Threading to maximum turning length with carriage or saddle is made possible by a full length lead screw. An all-sliding-gear quick-change gear box with a single lever pitch selector, provides a wide range of pitches. Both cross slide and saddle are equipped with power rapid traverse, and the turret is power indexed.

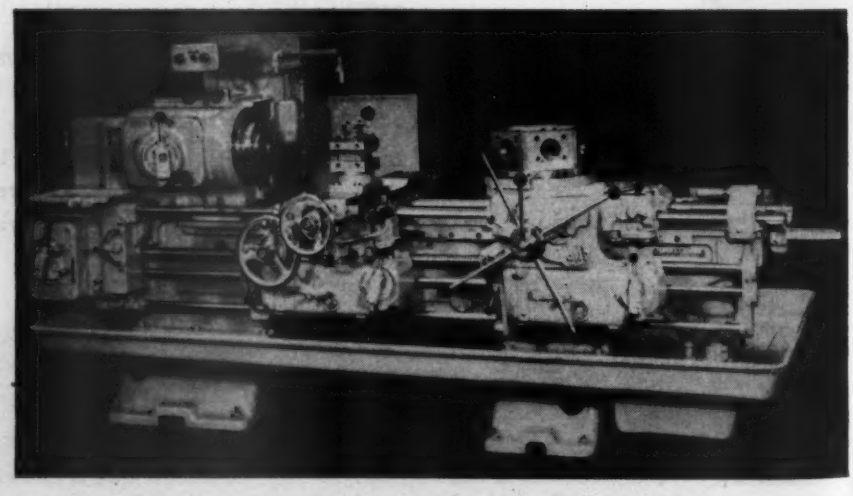
Two ranges of twelve spindle speeds, 20 to 1,000 r.p.m. or 30 to 1,500 r.p.m. are available, with a constant speed motor. Selection is made by a single lever speed selector.

Meter for Corrosion And Electrolysis Testing

A small model of a multi-combination meter designed specifically for electrolysis and corrosion investigations and cathodic protection testing in both field and laboratory has been made available by M. C. Miller, 1142 Emerson avenue, West Englewood, N. J.

It is made with either of two sets of instruments. In Model B-1, the low-resistance voltmeter is 1,000 ohms per volt, and the high-resistance voltmeter is 20,000 ohms per volt. In the Model B-2, the low-resistance voltmeter is 3,000 ohms per volt, and the high-resistance voltmeter is 62,500 ohms per volt. Nine ranges from 10 mv. to 100 volts are provided on the low-resistance voltmeter. Six ranges from 0.1 volt to 20 volts are provided on the high-resistance voltmeter. A milliameter-ammeter is provided with nine ranges from 2 m.a. to 20 amp.

The tester is said to be highly versatile and provides for measurement of practically all corrosion and cathodic protection testing. It is claimed that this in-



ONE LATHE... ONE OPERATOR...

twice as many wheel sets

with **PROFILING**

In addition to higher production, profiling brings you these advantages:

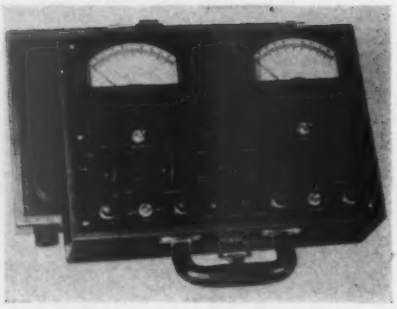
- Because of lower tool pressure, concentricities of .002" to .004" can be obtained—at least equal to those produced by grinding.
- Both wheels are turned to exactly the same tape size—every time.
- With carbide tools, skid flats can frequently be turned out with cuts of as little as ⅛" to ¼"—at a big saving in metal (and wheel life)!

The new method of turning wheel treads by profiling is going to change, completely, your wheel-shop practices. Profiling permits the use of carbide tools—with cutting speeds of 120 to 150 feet per minute and a feed of ½" per minute. A single cut completes the cutting, the finishing, and the flanging cycles, eliminating the conventional set of roughing, finishing and forming tools. With profiling, it is possible to achieve a 20-minute floor-to-floor time—and for light cuts, even this time can be reduced. Thus a production of 18 to 20 pairs in an 8-hour day is entirely possible.

Several Niles hydraulic-feed car-wheel lathes equipped for profiling are now in use in prominent railroad shops. Others are on order. We will be glad to help you in your arrangements to see one of these in operation. Just call the Lima-Hamilton sales office in New York, Chicago, or other principal cities, or write direct to Lima-Hamilton Corporation, Hamilton, Ohio.

LIMA HAMILTON CORPORATION

NILES TOOL WORKS CO. • *A Division of Lima-Hamilton Corporation* • **HAMILTON, OHIO**



strument greatly reduces the time for field and laboratory testing as it eliminates connecting up the many separate instruments frequently required. It is lightweight (about 13 lb.) and compact, being in a 9-in. x 12-in. x 6-in. walnut case. Standard flashlight dry cells are used and can be replaced easily without soldering. Schematic wiring diagrams showing typical uses in corrosion and cathodic protection testing, and suggestions for use are supplied with each meter.

Accessory Tools For Maintenance Shops

A series of four new all-purpose tools designed for general maintenance work has been announced by the J. H. Williams & Co., 400 Vulcan st., Buffalo 7, N. Y. They are the combination vise, stand and pipe bender; combination slip-joint pliers; aluminum pipe wrench; and a stud remover.

The vise stand, made of aluminum has the advantage of rigidity combined with light weight. Its reinforced design prevents distortion under severe service. Two pipe benders are provided one for pipe up to ½-in., the other for pipe up to ¾-in. Recess for oil-can and handy slots for tools are provided in addition to the vee pipe support. The aluminum alloy legs may be folded and tied together with permanently attached chain. This new stand includes a pipe which handles ⅛ to 2-in. pipe.

The slip-joint pliers are available in 5, 6, 8 and 10-in. sizes. A 7-in. size is also made with a side cutter. The special high carbon steel, is heat-treated after forging in such a manner as to avoid decarburization of the jaw and joint areas assuring long life for the broached teeth in the jaw gripping surfaces. These individually cartoned pliers are finished in bright nickel plate with jaw and handle areas buffed bright.

Williams aluminum pipe wrenches are drop-forged from high tensile aluminum alloy heat-treated for maximum strength and toughness. Their strength and long-wearing qualities are comparable with heavier iron or steel wrenches. Replaceable alloy steel jaw inserts are interchangeable. The same insert fits handle or movable jaw. Multiple dove-tail design and retaining screw assure easy assembly and firm anchorage. Inserts are cadmium-plated. The movable jaw is suspended between two springs of unique design. Gripping action is immediate and positive.

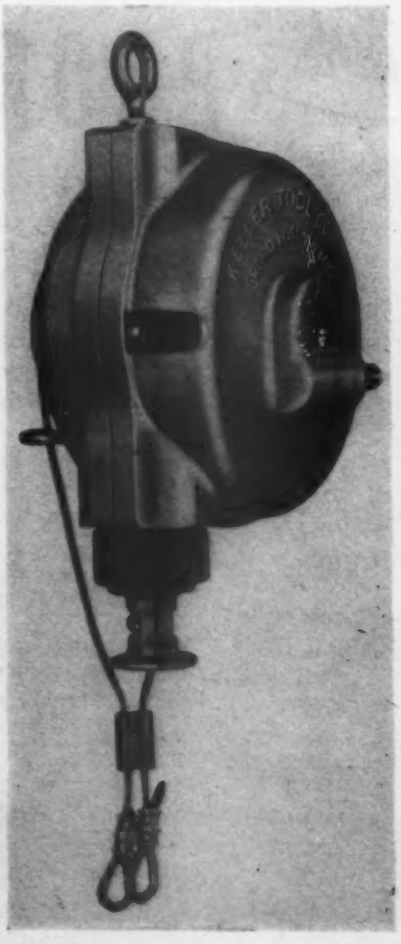
The stud remover model No. S-60B, is designed for use with ½-in. square drive handles and attachments. It is equally efficient for removing or setting studs.

An eccentrically mounted roller with deep milled edge provides a non-slipping gripping surface which is non-burring. Stud capacity is 5/16 to ¾-in. diameter. This device is made from selected alloy steel, heat-treated and chrome-plated.

Tool Balancer

A tool balancer is now available from the Keller Tool Company, Grand Haven, Mich., which suspends tools weighing up to 20 lb. over the work areas, supplements the services of Keller balancer 65A-2, of 10-lb. capacity.

Both balancers, the manufacturer states, materially reduce loss of production time, protect workers from fatigue, and eliminate careless tool handling.



High-Temperature Insulating Tape

An electrical tape that will stand temperatures up to 300 deg. F. is being made by the Minnesota Mining and Manufacturing Company, St. Paul, Minn. The tape, "Scotch" brand electrical tape No. 27, is used alone, without other insulating materials. It has a glass cloth backing that is fireproof, and a thermosetting adhesive that sets at 250 deg. F. in two hours, or 300 deg. F. in one hour. It contains no sulphur.

The glass cloth is unaffected by moisture, will not shrink, stretch or rot, and has a tensile strength of 150 lb. per in. of width. Among uses for the tape are insulating outside transformer coils, taping down armature hoods, making splices

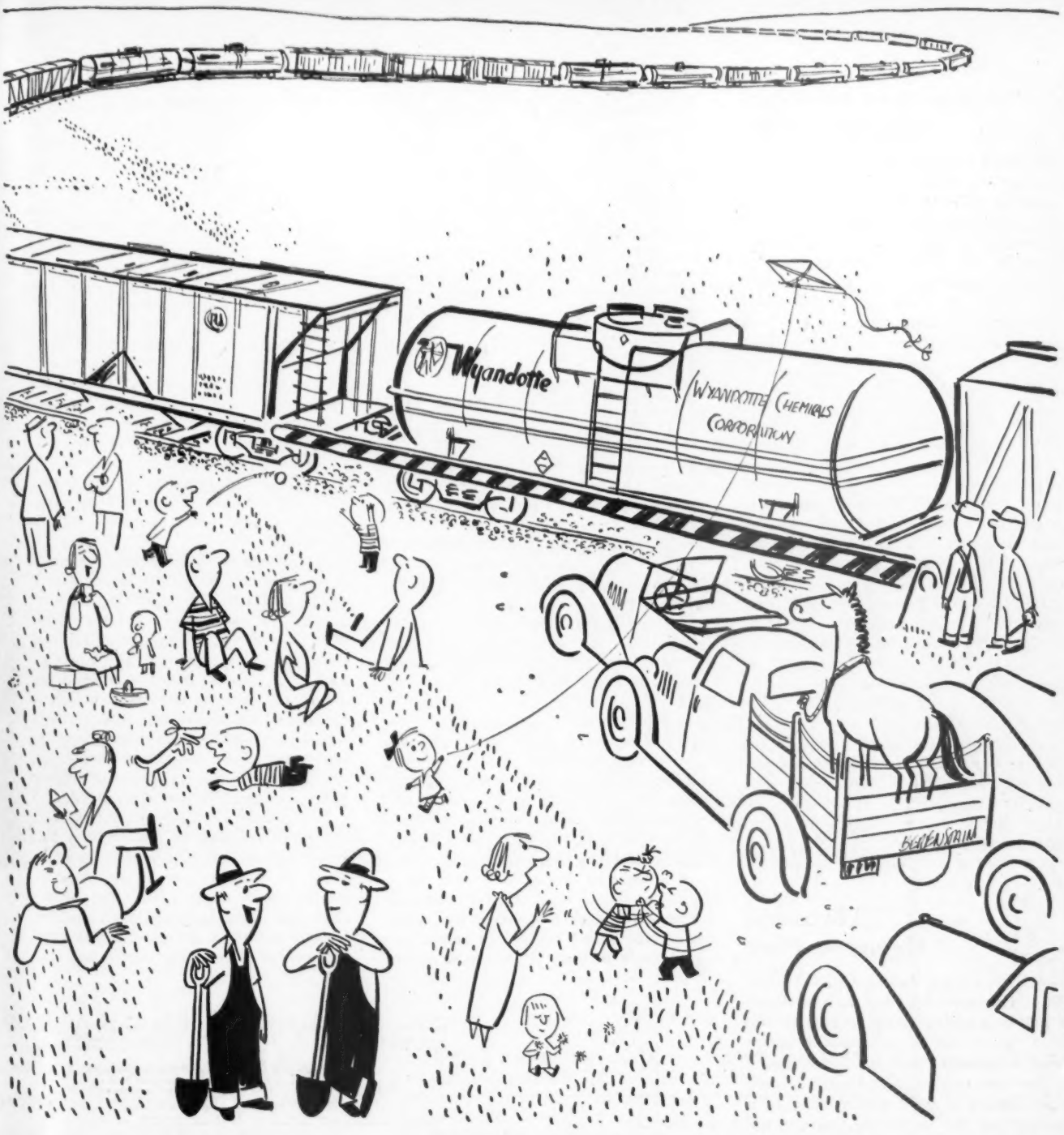
in the charger control boxes of foundry cupolas, splicing wires under cooking units of commercial ranges, and protecting feeder cables in light pole installations.

Electric Drill With 1¼-in. Capacity

A specially designed and engineered electric drill for all types of heavy construction and maintenance work has been announced by the Mall Tool Company, 7813 S. Chicago Ave., Chicago 19. A time and effort saver in drilling metal, wood and driving lag screws and running nuts, this unit has a capacity of 1¼ in. and is their model 540A.

Special construction features include a heavy-duty Universal motor for 115-volt. a.c.-d.c. operation (also available for 230 volts), an on-and-off switch in control handle, an interlocking reverse switch, a detachable side pipe handle, Timken roller bearings, a No. 3 Morse taper and a triple gear reduction. Operating speed is 150 r.p.m.

Model 540B is also available. This unit's speed is 90 r.p.m. Optional equipment for the drill includes a ⅝-in. Jacobs chuck, slip clutch that can be set for predetermined pressure and socket wrenches from ⅞- to 1½-in. capacities.



"They've been waitin' here for seven hours"

You'll never have to wait this long for a moving train at a railroad crossing, but that's what *would* happen if the annual production of Wyandotte Chemicals Corporation were put into a single freight train. It would take more than 29,000 tank, box, dry ice and hopper cars to carry the 1,250,000-ton load. Moving at 30 m.p.h., the 222-mile-long train would pass a given spot in about seven hours.

Wyandotte Chemicals Corporation, with its own sources of raw materials, is the world's largest manufacturer of specialized cleaning compounds for business and industry. Wyandotte makes the *complete* line of railway cleaners.

No matter what your cleaning needs may be, you'll find there's a Wyandotte Product made to do the job efficiently, economically.

For details, write or call your nearest Wyandotte representative.

• WYANDOTTE CHEMICALS CORPORATION
WYANDOTTE, MICHIGAN • SERVICE REPRESENTATIVES IN 88 CITIES

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REG. U. S. PAT. OFF.

Solenoid Operated Automatic Oiler

The latest addition to a line of lubricating devices produced by Oil-Rite Corporation, 3441 So. 13th st., Milwaukee 7, Wis., is an electric oiler which is entirely automatic in operation. Oil is released from the reservoir by a solenoid operated valve through single or multiple sight feed valves to a number of individual bearings to be lubricated.

Applications include use with machine tools, punch presses, conveyors, chain lubrication, driving rods, etc.

The solenoid in this model DE unit is connected across the line of the driving motor of the machine whose bearings are to be lubricated. When the motor switch is turned on, lubrication of the bearings starts immediately. There is no toggle switch to be turned on or off, and the single reservoir will feed up to 24 bearings thus replacing many individual oilers.

Hair-line adjustments on each feed valve can be made and retained through the use of a friction screw, the amount of friction being varied by tightening or loosening the knurled lock nut, depending upon individual conditions. This screw can be locked against severe vibration.

The oiler can be operated manually in case of power failure. Standard models are available in five body sizes with capacities from 9 oz. to 1 gal., up to 24 feeds, for standard voltages and frequencies.

Threaded Magnetic Plug

The U. S. Plug & Fitting Co., Frederick Bldg., Cleveland 15, Ohio, has developed a line of magnetic plugs ranging in size from ¼ to 1½ in. in standard square head, countersunk and special designs.

The construction of the plug is such that cleaning is easily accomplished by a blast of air. By varying the length of the supporting stem, the magnet is placed in the lubricant stream where it can do most good. The magnets used are of sintered (permanent Alnico) that possesses a high attractive force.

The normal wear of piston rings, gears and other moving parts often deposit in the lubricant small particles of ferrous abrasive metal, that if not removed, may result in excessive wear of these moving parts. This magnetic plug has properties that will effectively remove and hold ferrous metal particles from a moving lubricant.

The magnet is attached to the plug with a non-ferrous metal stem, eliminating dissipation of the magnetic force which would occur if directly attached to the ferrous plug.

All magnetic plugs are threaded with Dryseal thread, and are completely interchangeable with any standard Briggs type pipe thread. The use of Dryseal threads effects a seal without the use of pipe dopes or compounds. The seal is accomplished by a metal to metal contact which is produced by a truncation of the major diameter (root) of the internal thread and the truncation of the minor diameter (root) of the external thread.

Lathe for Reboring Diesel Liners

Roads operating Diesel power are confronted with the problem of cylinder liner maintenance which involves the reboring of liners. In the majority of shops this job is handled on an assorted variety of available equipment with makeshift adaptations resulting in costly maintenance and sub-quality.

The American Tool Works Company, Cincinnati, Ohio, has developed equipment especially for this operation. A standard 20-in. heavy duty Pacemaker lathe is used as the basic machine, to which is applied a spring-actuated profiling attachment with hardened and ground steel guideways. This attachment carries a hardened steel template against which a rider is held by a heavy spring which in turn controls the movement of the tool slide to reproduce the template form in the bore of the liner.

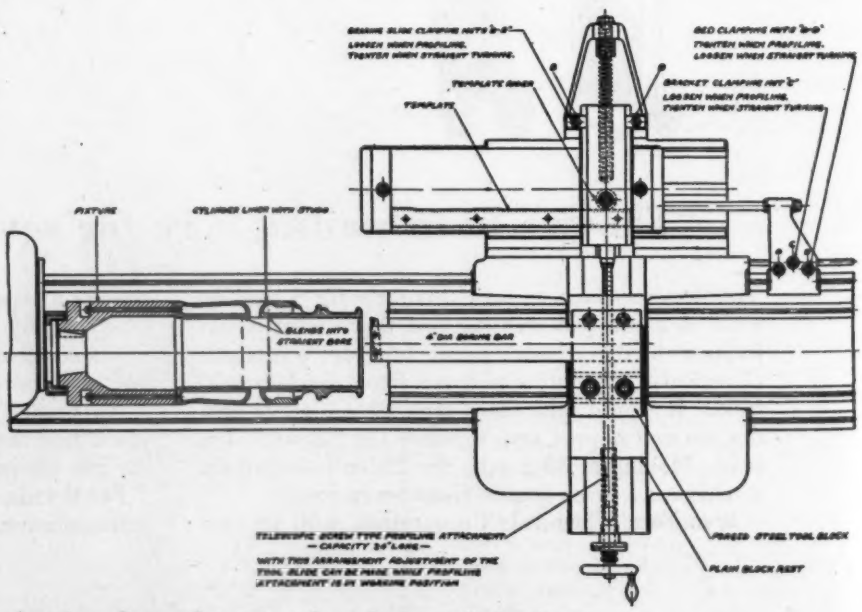
A substantial boring bar, held in a forged steel tool block securely clamped to the plain block rest, carries a cemented carbide boring tool so the boring operation may be done at the correct speed and feed to produce the desired finish in the fastest possible time. Particular attention is called to the fact that with this equipment a blend of the relief with the straight bore is accomplished and the chamfer at the stud end is secured all in one setting.

A floor-to-floor time of 50 minutes, based upon a boring speed of 275 ft. per min. and a .005-in. feed and including 18 minutes for handling, is considered normal for this equipment. Stock removal is 1/64 in. on a side.

For holding the cylinder liner securely a flange type fixture is mounted directly on the spindle nose against which the liner is bolted by means of the studs which are fixed in the liner when it is removed from the engine. This fixture is made very accurately in order to hold the liner in perfect alignment for the boring operation and is carefully balanced to permit of high speed operation without vibration.

An advantage offered by this machine is its ability to be almost instantly converted to a standard engine lathe adaptable to the wide variety of lathe operations encountered in the average railroad shop. By simply loosening the two nuts marked *D*, shown on the accompanying sketch, the profiling attachment which is bolted to and travels with the carriage becomes inoperative and the lathe is ready for standard lathe operations. The boring bar and holder may be removed quickly and a standard tool post substituted.

The lathe swings 22½ in. over the bed and carriage wings and 15 in. over the tool rest. For maximum service it may be driven by a 30 hp. motor; has 18 or 37 spindle speeds up to 1,600 r.p.m., if desired, and is regularly equipped with renewable hardened and ground tool steel bed vees for the carriage to ride on.



American Pacemaker set-up for reboring cylinder liners

The new General Motors F7 provides ample water- and steam-generator capacities for either single- or multiple-unit operation in heavy-duty passenger service:

	FP7A	F7B
WATER CAPACITY *(without dynamic brakes)*	**1,750 GALLONS**	**1,800 GALLONS**
WATER CAPACITY *(with dynamic brakes)*	**1,150 GALLONS**	**1,200 GALLONS**
STEAM-GENERATOR CAPACITY	**2,500 POUNDS**	**4,000 POUNDS**

ELECTRO-MOTIVE

DIVISION OF GENERAL MOTORS LA GRANGE, ILL.

GENERAL MOTORS LOCOMOTIVES

Home of the Diesel Locomotive

NEWS

Age of Freight Cars

THE following table, based on data published by the American Railway Car Institute, shows by age groups (according to the year originally built) the number of freight-carrying cars owned by Class I steam railways on January 1, 1939 and 1949. This method grouping, as well as the figures and statements which follow, is subject to qualification by reason of the fact that some of these freight-carrying cars have been rebuilt at some time after their original construction. However, the Bureau of Valuation of the Commission estimates that these rebuilt cars do not comprise above 10 per cent of the present cars and this is supported to some extent by comparisons of the annual figures of new and rebuilt freight car installations in the past decade.

In the 10-year period, there was an increase of only 4.9 per cent in the total number of freight-carrying cars and this naturally affects somewhat the changes in the age distribution. Somewhat curiously, the figures indicate that the proportion of freight cars has substantially increased in both the lowest and highest age groups. Thus the proportion of cars one to five years old increased from 9.15 to 15.17 per cent and those from one to ten years old from 17.40 to 28.84 per cent. On January 1, 1949, the proportion of cars 15 years old or less was practically the same as on January 1, 1939. On the other hand, cars over 25 years old increased from 25.23 per cent in 1939 to 34.68 per cent on January 1, 1949. Cars 21 years old and over increased from 45.60 per cent of the total to 53.61 per cent.

Of the 611,070 cars in the over 25-year age group, 338,204 or 55 per cent were more than 30 years old. In making these comparisons no account has been taken of changes in the assignment of railways to Class I.

Freight Carrying Cars Owned By Class I Railroads—By Age Groups *

Age (Years)	*As of January 1, 1939*	*Per cent of Total*	*As of January 1, 1949*	*Per cent of Total*
1 to 5	153,775	9.15	267,410	15.17
6 to 10	138,658	8.25	240,883	13.67
11 to 15	343,516	20.44	153,386	8.70
16 to 20	278,344	16.56	155,910	8.85
21 to 25	342,306	20.37	333,580	18.93
Over 25	424,024	25.23	611,070[1]	34.68
Total	1,680,623	100.00	1,762,239	100.00

* Based on date originally built
1 Includes 338,204 cars over 30 years old
Source: Statistics of Car Building and Car Repairing (1938 and 1948 editions) published annually by American Railway Car Institute

Coal-Weighing Tenders For British Locomotives

BRITISH RAILWAYS are to equip nine locomotive tenders with coal weighing apparatus, following experiments with two tenders already in use on the London Midland Region.

The apparatus consists of a separate

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE NOVEMBER ISSUE

LOCOMOTIVE ORDERS

Road	*No. of locos.*	*Type of loco.*	*Builder*
Illinois Central	9[1]	1,000-hp. Diesel-elec.	American Loco. Co.
Pennsylvania	45[2]	Diesel-elec. road frt.	American Loco. Co.
	5[2]	Diesel-elec. road pass.	Baldwin Loco. Wks.
	176[2]	Diesel-elec. yard switch	Electro-Motive Fairbanks, Morse General Electric Lima-Hamilton

FREIGHT-CAR INQUIRIES

Road	*No. of cars*	*Type of car*	*Builder*
Union Pacific	2,500	50-ton box	
	750	40-ton stock	
	250	50-ton flat	
	1,400	50-ton gondola	
	100	70-ton gondola	

PASSENGER CAR ORDERS

Road	*No. of cars*	*Type of car*	*Builder*
Great Northern	6	Mail-baggage	American Car & Fdry.
	6	Bagg.-dormitory	American Car & Fdry.
	6	60-pass. coaches	American Car & Fdry.
	6	Coffee-shop-lounge	American Car & Fdry.
	6	36-pass. dining	American Car & Fdry.
	6	36-pass.-obser.-lounge	American Car & Fdry.
	30[3]	Sleeping	Pullman-Standard

[1] Estimated cost $1,000,000. Delivery of these units in February 1950, will permit complete Dieselization of the road's steam division.

[2] The new road locomotives will be assigned to main-line service in various parts of the system. The 176 new Diesel switchers, added to 449 already in operation, will enable the Pennsylvania to completely Dieselize its switching operations at many points. Deliveries are scheduled to begin in January, 1950, and are expected to be substantially completed by August, 1950.

[3] Sixteen of the 30 sleepers will be of the 1 compartment-3 bedroom-7 duplex roomette-4 open section type, 8 of the 4 bedroom-16 duplex roomette type and 6 of the 2 compartment-5 bedroom-6 romette type. Delivery of all of the cars, which, with equipment previously ordered, will be used for the new streamliner fleet that will take over the "Empire Builder" run, is expected during the first half of 1951.

NOTES:

Chicago, Rock Island & Pacific.—The Rock Island is placing in service several completely streamlined, Diesel-powered suburban trains between Chicago and Joliet, Ill., and intermediate stations. The road was scheduled to receive during November the first group of 20 new suburban cars built by the Pullman-Standard Car Manufacturing Company, each with a seating capacity of 100 passengers. The Rock Island has already purchased 12 Diesel-electric locomotives for use in commuter service. The new cars are constructed of lightweight Cor-Ten steel and are equipped with roller bearings, high-speed electric brakes, Tightlock couplers and the latest all-coil spring trucks with snubbers and shock absorbing devices for easy riding. Entrance to the cars is provided by two sets of pneumatic-controlled sliding doors on each side of the car instead of the conventional vestibules at the ends. Hand rails and low-tread, anti-slip metal steps allow easy access to and exit from the cars. The coaches have fluorescent lighting, shatterproof Thermopane windows and thermostat-controlled heating. Twelve of the cars are air-conditioned and the remainder have forced filtered air ventilation. Trains assigned to the longer suburban runs, such as Joliet, will have washroom and toilet facilities.

Delaware, Lackawanna & Western.—The "Phoebe Snow," the Lackawanna's new streamline passenger train, was placed in operation between New York and Buffalo, N. Y., on November 15. Two complete units of the train provide daily service in each direction. Each train consists of eight or more cars, according to traffic requirements. Besides new coaches, there is a dining car and a tavern-lounge car containing an observation section available to all passengers. The westbound train carries a bedroom-roomette sleeping car, New York to Chicago.

Great Northern.— This road plans to purchase during 1950 50 Diesel-electric locomotives for passenger, freight and switching services, at a cost of $10,227,000. These will include 1 600-hp. and 6 1,000-hp. switchers; 31 1,500-hp. road-switchers; 5 3,000-hp. and 4 4,500-hp. freight locomotives; and 1 3,000-hp. and 2 4,500-hp. passenger locomotives. Some $4,585,000 will be spent for 500 steel refrigerator cars for the Western Fruit Express Company (a G. N. subsidiary), while an additional $2,050,000 will go for improvements to miscellaneous projects and for the purchase of machinery, tools and similar equipment.

Lower Diesel Maintenance Costs

Engines stay cleaner when lubricated with Texaco Dieseltex HD

YOU'RE not "experimenting" when you turn to *Texaco Dieseltex HD*. This fine railroad Diesel lubricating oil has proved its worth in service on the rails. It has more than enough of what it takes to meet the stiffest requirements of leading Diesel locomotive builders.

Texaco Dieseltex HD keeps engines cleaner, better protected and more efficient because it has high detergent-dispersive characteristics, plus an exclusive formula containing a special heavy-duty additive that gives exceptional resistance to oxidation and sludge formation.

Let a Texaco Lubrication Engineer show you how *Texaco Dieseltex HD* is increasing efficiency and economy for other railroads. Ask him to tell you about Texaco's Systematic Engineering Service. Just call the nearest Railway Sales Division office listed below, or write The Texas Company, *Railway Sales Division,* 135 East 42nd Street, New York 17, N. Y.

NEW YORK • CHICAGO • SAN FRANCISCO • ST. PAUL • ST. LOUIS • ATLANTA

TOLEDO, PEORIA & WESTERN RAILROAD — "Best East to West" — keeps these two 1500 h.p. Alco Road Switchers busy around the clock. They average 12,000 miles monthly. Both units are lubricated with *Texaco Dieseltex HD* exclusively.

TEXACO

TEXACO Dieseltex HD

FOR ALL RAILROAD DIESELS

TEXACO STAR THEATRE presents MILTON BERLE on television every Tuesday night. METROPOLITAN OPERA broadcasts every Saturday afternoon.

it's TOPS in its class

Fig. 2140
GLOBE
125 lb. S.P.
200 lb. W.O.G.

125 lb. S. P. BRONZE GLOBE, ANGLE and CHECK VALVES
Built to LUNKENHEIMER QUALITY STANDARDS

Circular No. 582 gives complete details on these new Valves. Mailed upon request.

Want a lower pressure valve to give the same dependable, low-cost service you get in higher pressure LUNKENHEIMER Valves?

Here it is — New Fig. 2140 Globe; Fig. 2141 Angle; Fig. 2142 Lift Check; Fig. 2144 Swing Check. These valves feature Lunkenheimer's traditionally fine design and sturdy construction, plus exclusive silicon bronze alloy stems which eliminate stem thread failure due to wear.

Whatever your requirements for lower pressure service, you'll find these new valves unequalled for dependability and true economy.

Fig. 2142 LIFT CHECK
125 lb. S.P. 200 lb. W.O.G.

Nowhere in the line is dependability more important than in Check Valves. These Checks function quickly and positively, seat accurately and tightly.

Fig. 2144 SWING CHECK
125 lb. S.P. 200 lb. W.O.G.

LUNKENHEIMER manufactures a wide variety of products for railroad service requirements . . . Valves of bronze, iron and steel; cocks, fittings, unions, air nozzles, boiler mountings and lubricating devices. Write for Circular No. 521, "LUNKENHEIMER VALVES for Railroad Service".

ESTABLISHED 1862
THE LUNKENHEIMER CO.
"QUALITY"
CINCINNATI 14, OHIO, U.S.A.
NEW YORK 13 CHICAGO 6
BOSTON 10 PHILADELPHIA 34
EXPORT DEPT 318-322 HUDSON ST. NEW YORK 13, N. Y.

bunker, with vertical sides and self-trimming back, which fits inside the tender and normally is locked on brackets when the locomotive is moving. To weigh the coal the locks are released and the load is transmitted by levers to a steelyard on which it can be measured by means of the usual sliding weights.

The specially fitted tenders will be tested on all types of locomotives to ascertain the amount of coal consumed when using the same or different grades of coal while performing the same class of work over any particular section of line.

The apparatus can also be used to ascertain the amount of coal used during various duties such as firing-up, in terminals, shunting, working the train, standing, etc. Locomotive inspectors travel with the tenders and record the consumption in detail. The variation in consumption because of various firing and working practices can be demonstrated to the engine crew so that they may make the most economical use of the coal.

I.C.C. Grants More Time To Install AB Brakes

THE Interstate Commerce Commission has given the railroads more time to install AB brakes on all freight cars used in interchange service, but it has set out a schedule which contemplates that all unequipped cars shall be equipped or withdrawn from service by December 31, 1951. The requirement that the brakes be installed was originally imposed by the commission's September 21, 1945, order in the No. 13528 proceeding, and the deadline was next January 1 when the latest extension order was issued.

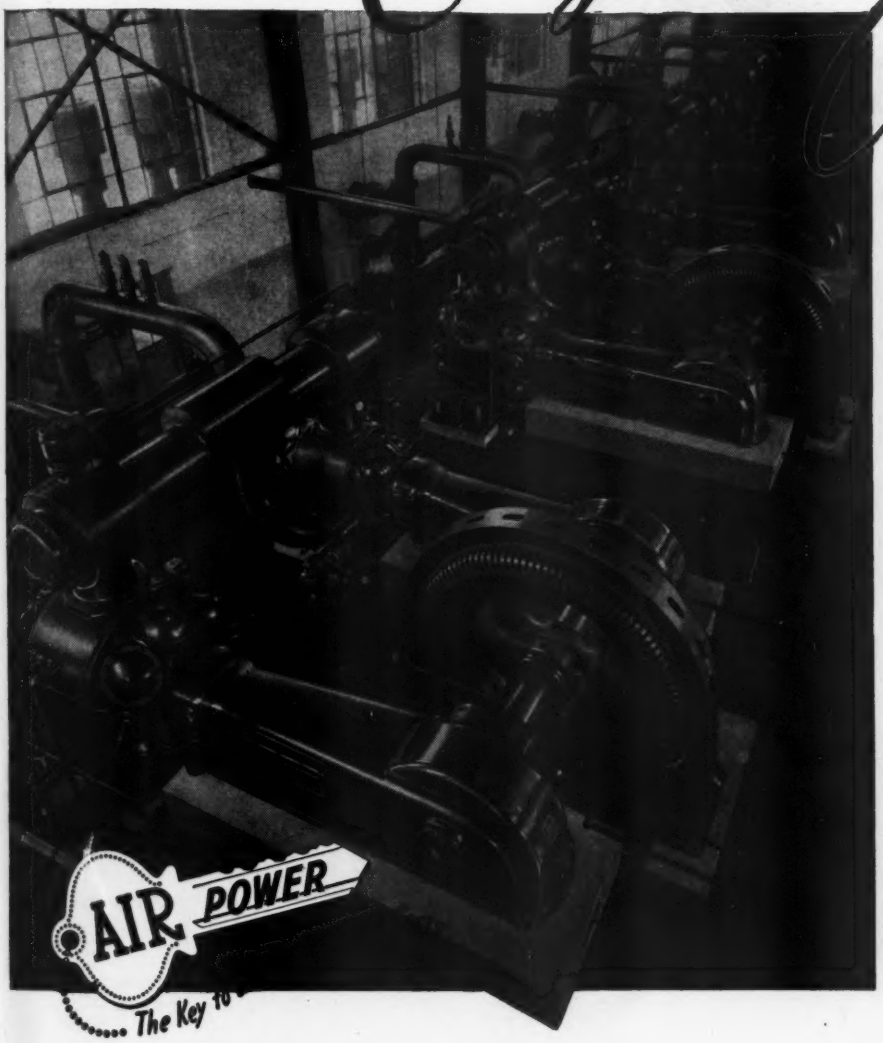
The latter, dated October 10, stipulated that all freight cars not equipped with AB brakes by next December 31 shall be equipped, or withdrawn from interchange service, in accordance with the following schedule: Where the number of unequipped cars is 2,000 or less, all shall be equipped or withdrawn on or before December 31, 1950; where the number of unequipped cars is over 2,000, one-half shall be equipped or withdrawn on or before December 31, 1950, and the remainder on or before December 31, 1951.

Friend Becomes Loco. Bureau Assistant Director

PRESIDENT TRUMAN has given James E. Friend a recess appointment as assistant director of the Bureau of Locomotive Inspection, Interstate Commerce Commission. The appointment was made on October 27, eight days after the "sine die" adjournment of the Eighty-first Congress' first session, at which the Senate took no action on the President's nomination of Mr. Friend for the same position.

Mr. Friend, who has been a district in-

BACK OF *Every* INGERSOLL-RAND *Compressor* ARE THESE *Sup*R*values*



This 2800-horsepower installation of Ingersoll-Rand *Class PRE Compressors* generates the Air Power for one of America's outstanding metal mines. It is typical of thousands of similar heavy-duty compressors that are so essential in practically every industry.

Whether they supply Air Power for Air Tools in factory, mine, or construction work, or compress hazardous gases at extremely high pressure in a costly process, the purchaser must rely upon the experience and judgment of the manufacturer for a dependable compressor that meets his specific requirements. To make sure you get the best, select an Ingersoll-Rand Compressor... backed by *Sup*R*values*

Tradition...a 77-year old company that grew from the *two of the earliest* compressor builders in America.

Experience and Know-how to build compressors for *any* pressure, *any* gas, *any* size, *any* service.

Facilities *second to none*... for design, research, metallurgy, and manufacture.

Range of sizes . . . with *standardized* frames, running gears and interchangeable cylinders ...plus *special* cylinders, valves and coolers for special applications.

Flexibility of Drive . . . a *choice* of compressors powered by electric motor, oil, gas, or steam.

Record of Performance ...thousands of compressors successfully operating in *every* branch of industry.

Design Features that give you the best in efficiency, durability, dependability, easy operation, and low maintenance.

Trained Personnel ...men who *know* Air Power...who build, sell, and service air drills and tools as well as compressors.

Progressive Policy...*continuous* pioneering and development of both new and old products.

Service ...with offices in principal cities *all over the world.*

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y. 267-I

COMPRESSORS • ROCK DRILLS • AIR TOOLS • BLOWERS • PUMPS • ENGINES • HOISTS • VACUUM EQUIPMENT

READY
In a Jiffy
TO THREAD
1" to 2" PIPE

RIDGID No. 65R gives real precision threads—quickly and easily

● In just 10 seconds you're ready to cut fast, accurate threads on 1," 1¼," 1½" and 2" pipe. Workholder sets instantly—only one screw to tighten, no bushings. The 65R has no extra dies for you to bother with; one set of high-speed steel chaser dies does the trick on iron, steel, brass or copper pipe or conduit. Buy work-saver 65Rs from your Supply House.

RIDGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL CO. • ELYRIA, OHIO

766 (Adv. 114)

spector of the bureau with headquarters at Memphis, Tenn., took his oath of office on October 31. Under the recess appointment, he will serve in the assistant directorship "at the pleasure of the President," but not longer than "the end of the next session of the Senate." The fact that he got the recess appointment would seem to indicate that the President will submit his nomination to the Senate again after Congress returns for its second session on January 3, 1950.

The original nomination, which has now been returned to the President, was pending before the Senate committee on interstate and foreign commerce at the time of adjournment. At hearings before that committee, Mr. Friend was opposed by the Brotherhood of Locomotive Engineers and Brotherhood of Locomotive Firemen & Enginemen, but was supported by the Railway Employees Department, American Federation of Labor, the International Association of Machinists, and the International Brotherhood of Boilermakers.

Mr. Friend, whose appointment was recommended to the president by the commission, came to the bureau in January, 1946, after about three years of service on the staff of the former Office of Defense Transportation. For some 20 years prior to 1942 he was employed by the Texas & Pacific, serving as general foreman and master mechanic.

SUPPLY TRADE NOTES

LUNKENHEIMER COMPANY.—In order to separate the functions of president and general manager of the Lunkenheimer Company, *Paul M. Arnall* has been appointed vice-president and general manager of the company, effective January 3. The management organization will then consist of *Frank P. Rhame*, president; Mr. Arnall; *Homer E. Luken*, vice-president and assistant general manager; *Harry A. Burdorf*, vice-president-sales, and *Edmund P. Lunken*, vice-president.

◆

FAIRBANKS, MORSE & CO.—*Russell A. Stevens*, formerly Diesel department manager, Los Angeles (Calif.) branch, of *Fairbanks, Morse & Co.*, has been appointed manager of the company's Boston (Mass.) branch. He succeeds *V. O. Harkness*, who has assumed the duties of Diesel sales department manager for the Boston area.

◆

ELLIOTT COMPANY.—*Harry A. Erb*, service manager of the steam turbine

Adding Years to TIREX CORD & CABLE LIFE

Yes, CURING-IN-LEAD is a big reason why TIREX Portable Cords and Cables stand up longer wherever rough usage is the order of the day.

CURING-IN-LEAD adds extra toughness to an already tough Selenium Neoprene jacket so that crushing and twisting, dragging over rough surfaces, pulling around sharp bends, and continual reeling and unreeling all find it well-nigh impossible to mar the efficient performance of TIREX Cords and Cables. And Selenium Neoprene Armor, in addition, provides stout resistance to oils, grease, chemicals, heat, flame, sunlight and weather hazards.

Doesn't this complete protection suggest longer cord and cable life to you? ... That's just what it means, and it is your assurance of low-cost trouble-free operation of all portable equipment from hand tools to heavy machinery.

For a complete description of the CURED-IN-LEAD Process, and of other "plus" values that TIREX products feature, write us today for Folder 993.

SIMPLEX-TIREX

SIMPLEX WIRE & CABLE CO.
79 Sidney Street
Cambridge 39, Mass.

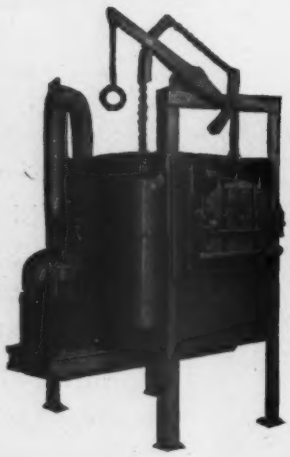
Specify JOHNSTON FURNACES

For DEPENDABLE Results . . . FAST!

JOHNSTON furnaces for every heating job—engineered and built to your needs. Known for SAFETY and DEPENDABILITY.

TOOL FURNACES

—designed to cover all ranges of tool heat treatment. Furnace shown is underfired, complete with Johnston Blower mounted as shown and oil burner mounted at rear. Furnace and combustion chambers separated by special hearth tile, with openings between arranged so that flame will not pass into heating chamber or strike the stock.

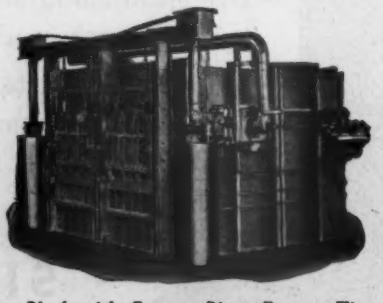


CAR BOTTOM FURNACES

—for annealing, normalizing and stress relieving. Clean heating, high efficiency and fuel economy is attained by the JOHNSTON "Reverse Blast" Low Pressure Burner. Roller bearing car axles and door hoist shafts, power operated car pullers and other practical features.

FORGING FURNACES

Single End Door Type shown has one chamber 9' wide, 6' deep, and two doors 20" high—one 2' wide, the other 2'6" wide. Other door arrangements to suit. Fired from the ends with two burners. Complete with Johnston Electric Type Valveless Automatic Control and hydraulic door hoisting mechanisms.



The JOHNSTON line also includes Blacksmith Forges, Rivet Forges, Tire Heaters, Burners, Blowers and other equipment to SPEED PRODUCTION—SAFELY!

THE JOHNSTON LINE — SAFETY DEPENDABILITY

JOHNSTON MANUFACTURING CO.
2825 EAST HENNEPIN AVE.
MINNEAPOLIS 13, MINN.

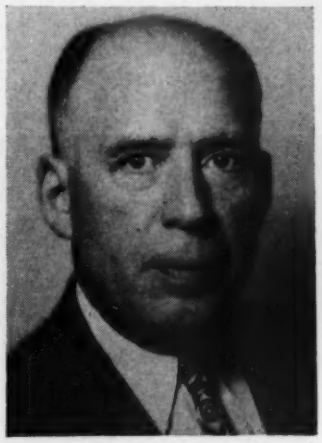
ENGINEERS & MANUFACTURERS OF INDUSTRIAL HEATING EQUIPMENT

department of the Worthington Pump & Machinery Corp. for the past six years, has rejoined Elliott as assistant to M. A. King, vice-president in charge of engineering, with headquarters at Jeannette, Pa.

◆

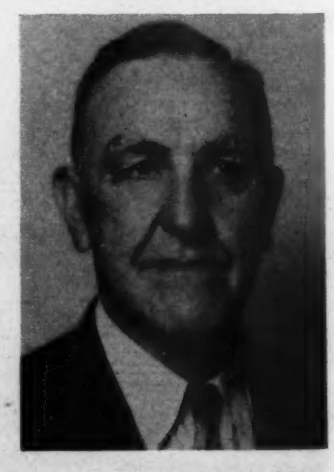
SAFETY CAR HEATING & LIGHTING CO. —*J. J. Kennedy* has been appointed vice-president in charge of engineering and sales of the Safety Car Heating & Lighting Company, with headquarters in New Haven. *Leonard Pierson* has been appointed vice-president in charge of service operations.

Mr. Kennedy, a graduate of Carnegie Institute of Technology, started his business career in 1919 with the Pyle-National Company in Chicago, first as electrical engineer and later as chief engineer. In 1930 he was appointed vice-president of the O. C. Kechley Company in Chicago. In 1935 he became design and development engineer of Safety Car Heating and Lighting, later sales engineer. Previous to becoming a vice-president he was director of the sales division.



J. J. Kennedy

Mr. Pierson is a graduate of Stevens Institute of Technology. He became affiliated with the Pintsch Compressing Corporation in 1909 and in 1942 became electrical superintendent of Special Service Company, both companies being subsidiaries of the Safety Car Heating &



L. Pierson

STRIPPING TWO CAR WHEELS SIMULTANEOUSLY AT N.Y.O. & W.R.R. SHOPS, MIDDLETOWN, N. Y.

All standard MCB car axles and wheels, together with trailer sets and diesel locomotive wheels, can be stripped in the Chambersburg Duplex Wheel Press with a speed unequalled by any other method.

STRIPPING DIESEL WHEELS AND GEAR SIMULTANEOUSLY

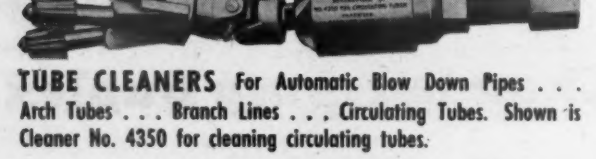
Details in Bulletin 18-L-8

CHAMBERSBURG ENGINEERING CO.

CHAMBERSBURG, PA.

OF RAILWAY MAINTENANCE MEN

TUBE CLEANERS For Automatic Blow Down Pipes . . . Arch Tubes . . . Branch Lines . . . Circulating Tubes. Shown is Cleaner No. 4350 for cleaning circulating tubes.



TUBE EXPANDERS Precision built of alloy steel . . . heat treated for uniform grain and hardness. Made for all tube sizes . . . for every requirement. No. 164 for 1" O.D. to 4" O.D. tubes is illustrated.

for complete information, write our Railway Sales Representatives

HURON MANUFACTURING COMPANY
3240 E. Woodbridge St. Detroit 7, Michigan

AIRETOOL
MANUFACTURING COMPANY
SPRINGFIELD, OHIO

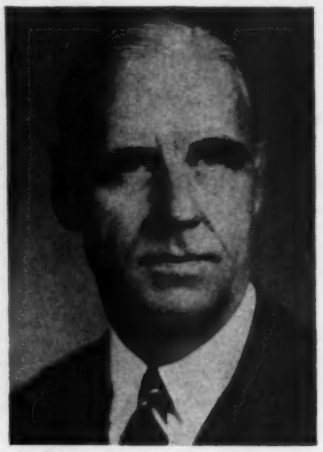
Lighting Co. Prior to becoming a vice-president he was director of engineering and research.

◆

PRESSED STEEL CAR COMPANY.—The general offices of the *Pressed Steel Car Company* will be moved to Chicago from Pittsburgh, Pa. All departments now in the Koppers Building in Pittsburgh will be transferred to Chicago, but a sales office will be maintained in Pittsburgh.

◆

GULF OIL CORPORATION.—*Daniel R. Winter*, formerly manager of national account sales for the Gulf Oil Corporation, has been appointed assistant general manager in charge of transportation sales, primarily direct sales to railroads, air lines and steamship lines. Mr. Winter joined Gulf Oil in 1933 as a special sales representative.



Daniel R. Winter

◆

GENERAL ELECTRIC COMPANY. A Diesel-electric school is being conducted by the General Electric Company in its Erie, Pa., plant. Here, G. E.'s Locomotive and Car Equipment Divisions offer instruction in operation, inspection and maintenance of that company's switching locomotives.

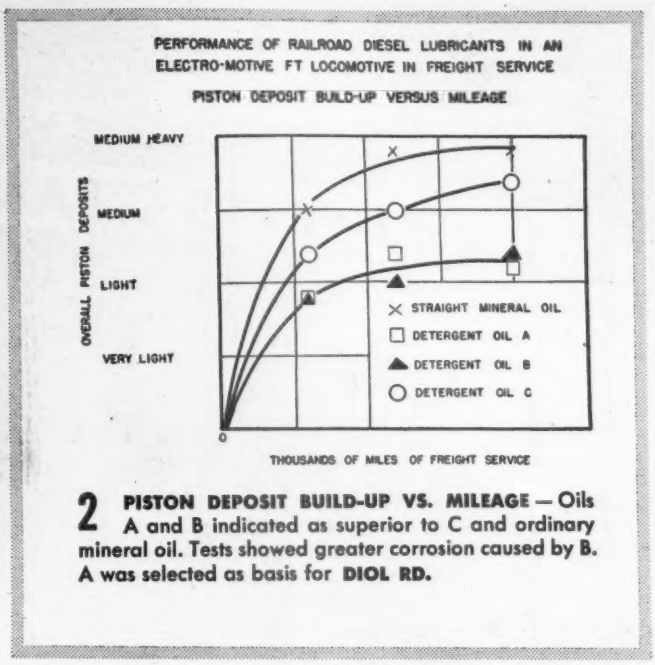
The program is tailored particularly for the personnel who will be working on the locomotives when they are in service. The classes are kept small, with a limit of about 20 people to a session. In this way, instruction can be personalized and kept flexible enough to meet the needs of the individuals in the class.

The school lasts a week and is offered free of charge. Selection of personnel to attend is made by the customer, who pays for the student's traveling and living expenses. There is no charge for enrollment, tuition, or books.

"Book learning" is kept to a minimum and practical work is stressed. Actual equipment parts are brought into the classrooms and the work is presented in everyday shop terms and practices. All sizes of Diesel-electric locomotives for industrial switching are observed on test and in actual operation on the test track.

A part of the course consists of tours

1 **EARL W. BALL,** Esso sales dept. lubrication engineer, watches **DR. LEONARD E. MOODY,** Standard Oil Development Co. research chemist, rate piston and rings for carbon and varnish deposits.



2 **PISTON DEPOSIT BUILD-UP VS. MILEAGE** — Oils A and B indicated as superior to C and ordinary mineral oil. Tests showed greater corrosion caused by B. A was selected as basis for **DIOL RD.**

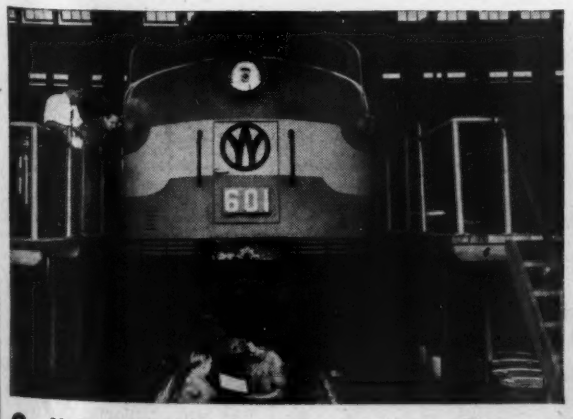
Diol RD...Great New Diesel Locomotive Lubricating Oil Developed in Largest Controlled Lubricant Field Test Ever Conducted!

A THREE-YEAR TEST—the most comprehensive ever conducted on diesel locomotive lubricating oils—has been completed by Esso.

ESSO'S LABORATORY ON WHEELS was a two-unit Electro-Motive locomotive equipped with V-type, 1,350 hp., 800 r.p.m., 16 cylinder, 8½ x 10 in. diesel engines. A complete set of testing instruments, including specially devised equipment, was installed and the locomotive was put into service on the N. Y., O. and W.

AT THE END OF THE TEST locomotive #601 had gone over a half million miles under varying conditions of load, speed and temperatures. A vast amount of important information and "know-how" on diesel operation had been accumulated . . . and a superior new lubricating oil had been developed. The oil, now named **DIOL RD,** is available in two grades: **74** and **76. DIOL RD** contains a special additive that *reduces engine deposits, inhibits corrosion, fights oxidation, is not lost in service.*

FOR FURTHER INFORMATION on DIOL RD 74 and 76 and this unprecedented 3-year test, contact Esso Railroad Sales Division, Esso Standard Oil Co., 15 West 51st St., New York 19, N. Y., today!



3 **N. Y., ONTARIO & WESTERN LOCOMOTIVE #601** as it was being equipped with testing instruments for Esso's 3-year, half-million mile controlled field test of diesel lubricants.

The Sign of QUALITY — Esso — The Symbol of SERVICE

RAILROAD PRODUCTS

SOLD IN: Maine, N. H., Vt., Mass., Conn., R. I., N. Y., Penna., N. J., Del., Md., D. C., Va., W. Va., N. C., S. C., Tenn., Ark., La.

ESSO STANDARD OIL COMPANY—Boston, Mass.—New York, N. Y.—Elizabeth, N. J.—Baltimore, Md.—Richmond, Va.—Charleston, W. Va.—Charlotte, N. C.—Columbia, S. C.—Memphis, Tenn.—Little Rock, Ark.—New Orleans, La.

ESSO STANDARD OIL COMPANY OF PENNSYLVANIA—Philadelphia, Pa.

HERE ARE
Time and Labor Savings FOR YOU
on DIESEL PARTS CLEANING

YOUR SHOPS can use the same cleaner and equipment as are used in the installation described below — to get equally effective cleaning and outstanding time savings in cleaning diesel parts.

Parts Cleaned—Diesel heads, liners, pistons, rods, wrist pins, piston baskets and carriers, snap rings, bearings, bearing races, timing gears, housing covers, blower supports, suction screens, lube oil separators, valves, etc.

Previous Methods and Time Involved—Boiling in a tank of hot caustic solution, followed by a great deal of hand labor with scrapers, brushes, etc. Time: 15-20 hours of boil-out never turned out parts which did not need hand work.

MAGNUS METHOD AND TIME INVOLVED—Parts are cleaned in a No. 6 Magnus Aja-Dip Sr. Cleaning Machine using Magnus 755 (plus 25% water). Solution is maintained at 130°-140°F. Time: 1½ hours, and parts are *completely* clean, needing no hand work.

Solution Life—Original charge of Magnus 755 has been in steady use 8 hours a day, 6 days a week, for 3 months. No make-up has been necessary, and cleaning is just as good as at the start.

Cleaning Quality — Better cleaning than they ever got with old method. Bronze and soft metal parts are especially bright. Carbon deposits around port holes of heads and liners are completely removed in the machine.

WRITE FOR THE MAGNUS RAILROAD DIESEL CLEANING MANUAL

Railroad Division
MAGNUS CHEMICAL COMPANY • 77 South Ave., Garwood, N. J.
In Canada—Magnus Chemicals, Ltd.
4040 Rue Masson, Montreal 36, Que.

Magnus CLEANERS
AND
CLEANING EQUIPMENT
Representatives in all principal cities

through the Erie Works to see the actual manufacturing processes. Students observe Diesel-electrics under construction in the various stages of manufacture and see the components as they are assembled in the locomotives.

When the course is completed, the students return to their respective companies to put into practice what they have learned.

◆

SYMINGTON-GOULD CORPORATION.—*H. T. Casey* has been appointed assistant vice-president of the Symington-Gould Corporation, with headquarters at New York.

◆

RIDGE TOOL COMPANY.—*L. C. Richardson* has been appointed sales representative in the intermountain territory of the Ridge Tool Company, Elyria, Ohio. The territory comprises Missouri, Kansas, Colorado, Arkansas, and Wyoming. Mr. Richardson's headquarters are in St. Louis, Mo.

◆

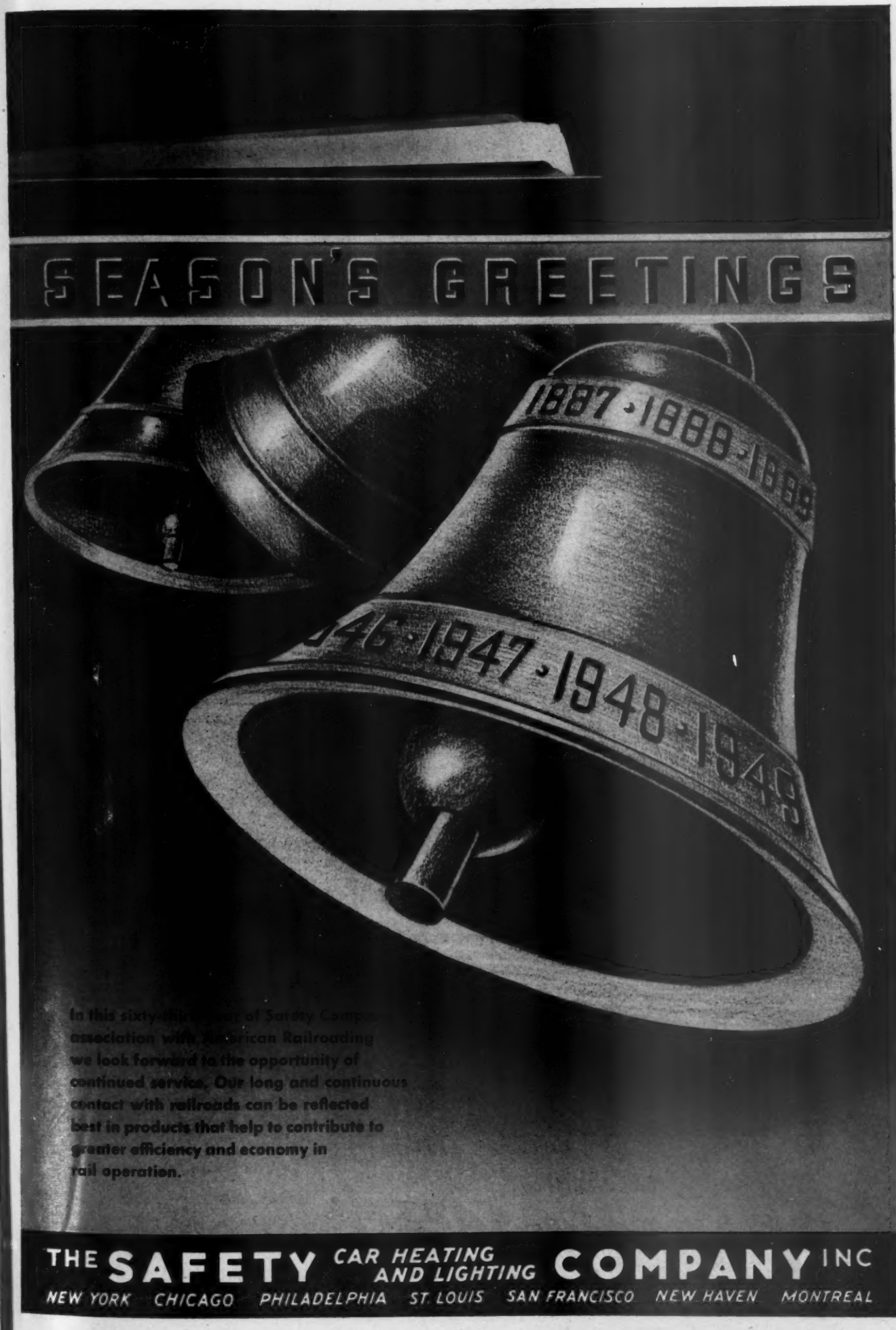
GENERAL MOTORS DIESEL LTD.—*Robert E. Hunter*, formerly a district sales manager of the Electro-Motive Division of General Motors in Chicago, has been named director of sales of the newly formed General Motors Diesel Ltd. Mr. Hunter will make his headquarters in Montreal where the company's sales offices have been established in the International Aviation Building. *Frederick W. Walker, Jr.*, has succeeded Mr. Hunter as district sales manager for Electro-Motive at Chicago.

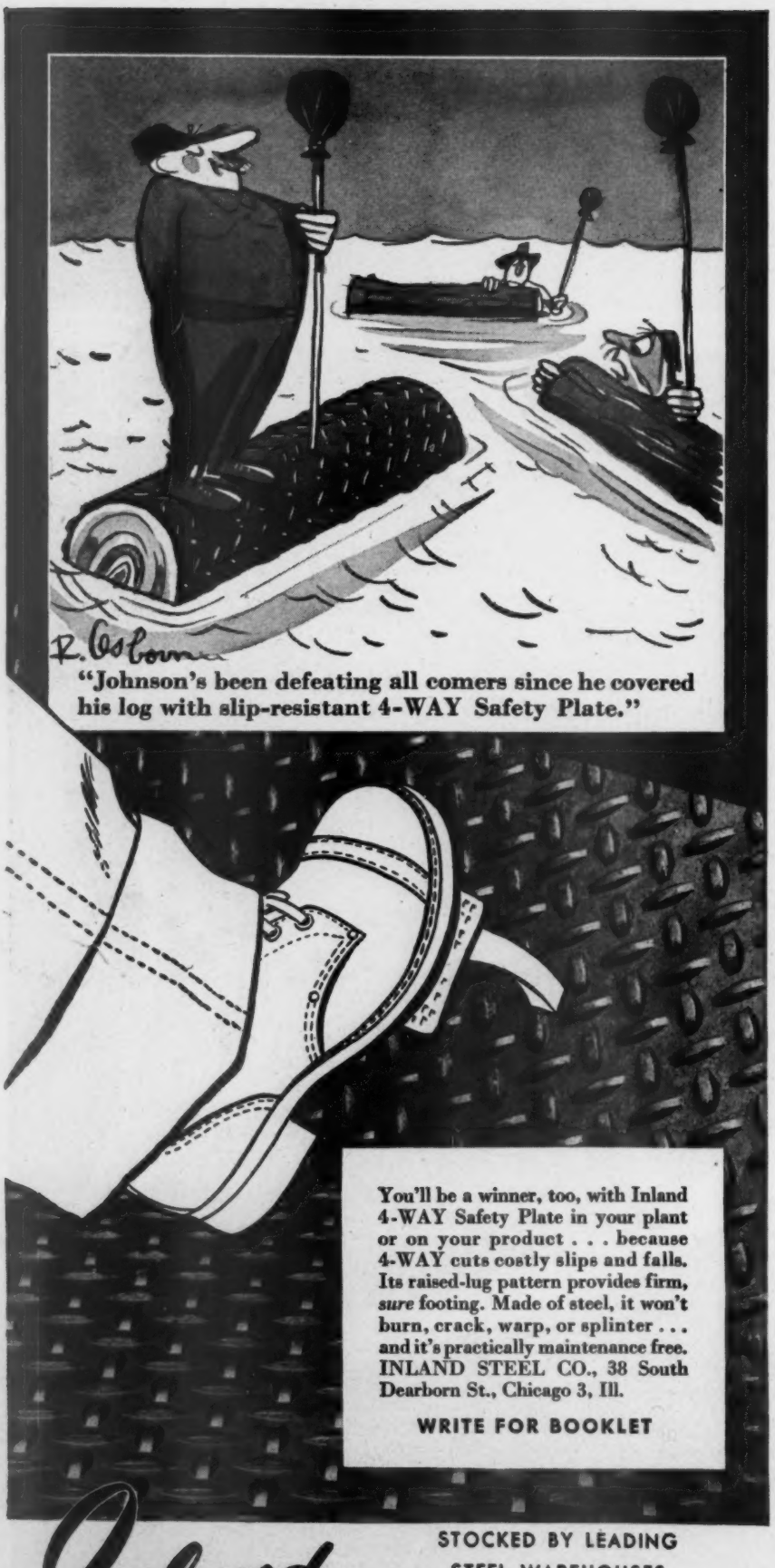
Mr. Hunter, who first joined General Motors in 1937 as business management manager with the Pontiac Motor Division, is a graduate of the University of Michigan. Following graduation he served in various sales capacities with

R. E. Hunter

Graham-Paige Motors Corporation and was associated with National Tube Company, a subsidiary of U. S. Steel Corporation in Industrial Relations. Joining Electro-Motive as assistant director of industrial relations, Mr. Hunter became manager of statistics and market analysis and then district sales manager at Chicago.

Mr. Walker is a graduate of Lehigh University, Bethlehem, Pa., where he re-


SEASON'S GREETINGS
1887 · 1888 · 1889
1946 · 1947 · 1948 · 1949
In this sixty-third year of Safety Company association with American Railroading we look forward to the opportunity of continued service. Our long and continuous contact with railroads can be reflected best in products that help to contribute to greater efficiency and economy in rail operation.
THE SAFETY CAR HEATING AND LIGHTING COMPANY INC
NEW YORK CHICAGO PHILADELPHIA ST. LOUIS SAN FRANCISCO NEW HAVEN MONTREAL



ceived the degree of B. S. in Industrial Engineering. Following graduation he took a summer position with the Great Northern, and then returned to his alma mater where he served as an instructor

F. W. Walker

in machine design during the 1936-37 academic year. He left Lehigh to join Electro-Motive in June, 1937, starting as an hourly apprentice. He progressed through the ranks to become application engineer in 1945 and in the following year was appointed manager of statistics and market analysis. He was on military leave from April, 1941, to December, 1945, entering the Army Air Force as a 2nd Lieutenant and rising to the rank of Lieutenant Colonel.

◆

AIR REDUCTION SALES COMPANY.—*H. R. Salisbury* has been appointed president of the Air Reduction Sales Company, with which he has been associated for over 23 years in various executive capacities. The following have been appointed vice-presidents: *H. F. Henriques* (general sales); *J. J. Lincoln, Jr.* (railroad sales and sales services); *S. B. Stouffer* (distribution), and *N. L. Wisser* (field office management).

◆

TOWNSEND COMPANY.—The *Townsend Company*, New Brighton, Pa., has established a new sales office in the Broad Street Station building, Philadelphia, Pa., under the direction of *Edward T. Brown*, sales manager of the eastern division.

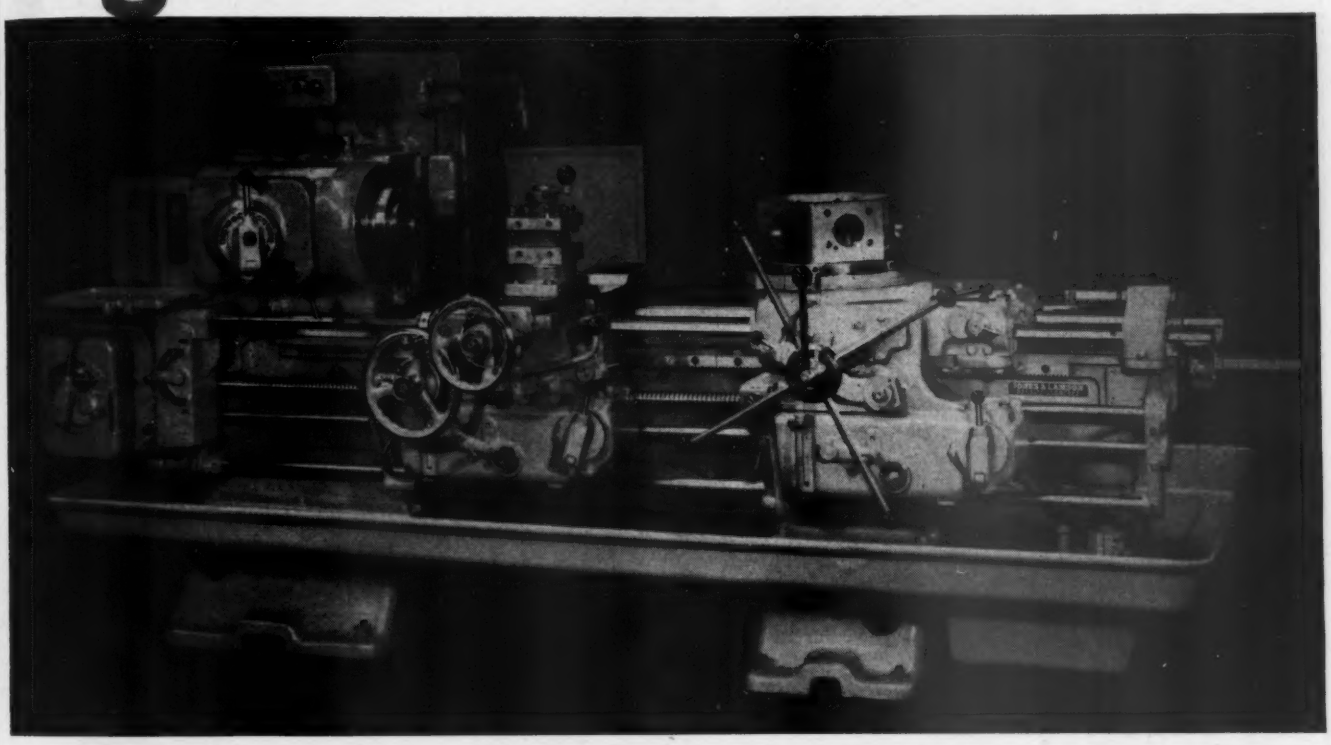
◆

UNION EQUIPMENT COMPANY.—The Union Railway Equipment Company has appointed the *Deems Supply Corporation*, 542 Fifth avenue, New York 19, as exclusive sales representative for Ureco devices in the eastern territory, including New York, Boston, Mass., Washington, D. C., Baltimore, Md., Philadelphia, Pa., Pittsburgh and Cleveland, Ohio.

◆

WATERBURY BATTERY COMPANY.—*William J. Gabb* and associates have acquired all the interest in, and the business of, the Waterbury Battery Company, Waterbury, Conn. Mr. Gabb has been elected president and treasurer and *Martin L. Martus*, the retiring president,

Over 4½ Tons of High Powered Precision!



NEW JONES & LAMSON SADDLE TYPE UNIVERSAL TURRET LATHE 7A

2½" Bar or 12" Chuck

Rugged, Functional Design, Heavy, Deep, Rigid Bed Gives New Production Efficiency

Full Length Lead Screw:

Carriage and Saddle Threading to Full Turning Length

Wide-Range, Single Lever Thread Selector

All-Sliding Gear Quick-Change Gear Box

Automatic Safety Interlocks on Threading Controls

Power Rapid Traverse for Cross Slide and Saddle—Power Indexing Turret

Lower, Wider Chip Pan with Centrifugal Coolant Pump

12 Spindle Speeds with 20 Horsepower Constant Speed Motor

All Tooling Interchangeable with Previous 7A Models

— ***PLUS*** all the famous Jones & Lamson characteristics of easy operation, versatility and repetitive accuracy!

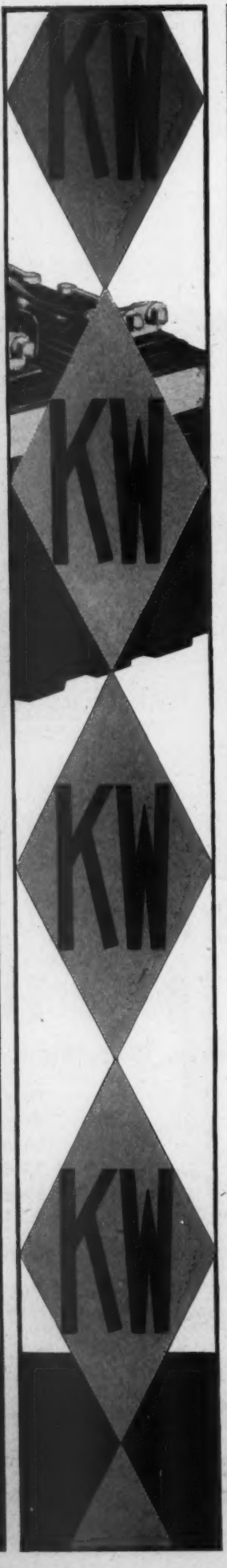
Built & Powered to Produce *MORE chips per tool, MORE pieces per hour, MORE profit per job*—than any turret lathe of comparable size!

Turret Lathe Division **JONES & LAMSON** MACHINE COMPANY
Springfield, Vermont, U.S.A.

MACHINE TOOL CRAFTSMEN SINCE 1835

✓ *Write to Dept. 710 for Complete Information*

Depend on



the battery that's Designed for Diesel Duty—

AND DOES THE JOB IT'S DESIGNED TO DO!

Diesel driven equipment demands...

- A Battery that gives a large volume of current at starting motor voltage requirements . . .
- A Battery that maintains operating voltages at low temperature limits . . .
- A Battery that's built with high electrical efficiency and conducting capacity . . .
- A BATTERY THAT'S DESIGNED TO SATISFY THESE AND THE MANY OTHER AUXILIARY DEMANDS OF DIESEL SERVICE . . .

K. W.! Depend on K. W. to do the job it's designed to do!

K. W. BATTERY COMPANY, Inc.

3705 N. LINCOLN AVE. CHICAGO 13 — Foot of MONTAGUE ST. BROOKLYN, 2

771 (Adv. 124)

will continue in an advisory capacity. *G. A. Nelson* will continue as vice-president and sales manager, serving railroad requirements for primary batteries.

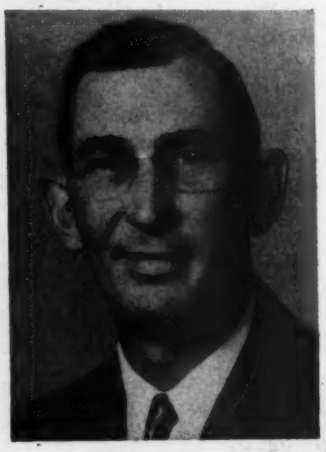
◆

VAPOR HEATING CORPORATION.—*L. G. Bolin* has been placed in charge of service responsibilities to railroads operating in and near Denver, Colo., for the Vapor Heating Corporation. Mr. Bolin, who will now have his headquarters in the Equitable Building in Denver, has been with Vapor Heating Corporation for several years, working with railroads in the Chicago area.

◆

MORTON - GREGORY CORPORATION.—*Elwood E. Zerbe* has been appointed field engineer in the Atlanta, Ga., district for the Nelson stud welding division of the Morton-Gregory Corporation, with headquarters at 965 Crescent avenue, N.E., Atlanta.

Mr. Zerbe began his career as an apprentice in the Altoona, Pa., shops of the Pennsylvania, with which road he remained for 20 years, advancing to the



Elwood E. Zerbe

position of machine shop foreman. For four years he was employed by the Franklin Railway Supply Company at New York. Early this year he became a specialist on railroad applications for the Nelson stud-welding division of Morton-Gregory.

◆

BALDWIN LOCOMOTIVE WORKS.—*Dana R. Staples* has been appointed manager of the newly consolidated locomotive engineering department of the Baldwin Locomotive Works, which covers Diesel-electric, steam, turbine and electric locomotives. Other appointments in that department are as follows: *Ralph Schmidt*, manager, mechanical section; *Ralph A. Miller*, manager, electrical section; *John T. Shatagin*, manager, development section, and *Warren B. Darlington*, supervisor, drawing office.

◆

GRAYBAR ELECTRIC CO.—*G. F. Hessler*, vice-president of the Graybar Electric Company, has been appointed to head the company's sales activities. *H. P. Litchfield*, formerly assistant general

MODERN TRACTION MOTORS DEMAND

*MODERN LUBRICATORS!

Typical installation of a Felpax Lubricator in the axle cap of a Diesel locomotive traction motor.

Patented and Patents Pending

Tests prove . . .

. . . That bearings run cooler with FELPAX Lubricators because they feed more oil to the journals than 98% wool yarn.

FELPAX PROVIDES POSITIVE LUBRICATION

Note the simple easy method of installation of the Felpax Lubricator in the axle cap as illustrated above.

UNDER MAXIMUM LOADS...AT HIGH SPEED AND CONTINUOUS OPERATION

With the first turn of the axle, FELPAX lubricators begin their job. The wicks are in constant contact with the journal providing continuous free flow lubrication. The FELPAX method of lubrication extends liner life and reduces wheel change-outs by as much as 75% due to lateral and radial bearing wear. FELPAX Lubricators are available for almost any sleeve bearing application on Diesel, Electric or Steam locomotives.

FOR FULL PARTICULARS
SEE YOUR LOCOMOTIVE BUILDER OR WRITE TO . . .

MILLER FELPAX CORPORATION
WINONA, MINNESOTA

Your Traveling Public

—appreciate the streamlined handsome appearance of a train—coaches with bright clean exteriors, suggesting a pleasant comfortable trip.
—Use PERMAG Compounds for clean operations.

Your Operating and Maintenance crew

—need a clean, safe, attractive interior to render the best service to patrons.
—Use PERMAG for every cleaning requirement.

How PERMAG Cleaning Compounds help

PERMAG is thoroughly adaptable to DIESELS. Can be used for interiors where electrical construction might interfere with wet compounds.
Our Technical Representatives would like to discuss any cleaning problem you have. Write us or 'phone.

MAGNUSON PRODUCTS CORPORATION

Mfrs. of Specialized Cleaning Compounds for Industry

50 COURT ST. BROOKLYN 2, N. Y.

In Canada: Canadian PERMAG Products, Ltd., Montreal, Que.

WILSON *Mobile* DE-ICING and DRYING UNIT

Below—Unit arranged for use in pit for de-icing and drying underbody equipment.

Fast, thorough drying of Diesel Locomotives and equipment . . .

• Portable, versatile Wilson Mobile De-Icing and Drying Units blow a large volume of warm air which evaporates water as the ice melts. Ideal for de-icing and drying locomotive interiors without damage to instruments and electrical equipment. Can be quickly changed for use in pit or on ramp. Radiation elements integrally cast in aluminum and tested to 500 p.s.i. Motors furnished to suit available electric circuits for operation on 220- or 440-volt lines. Write for complete data and blueprints.

Above—Unit arranged for use on ramps in diesel-electric maintenance plants, for cab interior equipment.

WILSON ENGINEERING CORP.

122 South Michigan Blvd. • Chicago 3, Illinois

sales manager, has been appointed general supply sales manager to head all supply lines, and *C. S. Powell*, vice-president, will head appliances and communication lines. Messrs. Litchfield and Powell will be under Mr. Hessler's direction.

◆

AMERICAN CAR & FOUNDRY CO.—*G. L. Gabrielson* has been appointed sales agent in the Pittsburgh, Pa., office of the American Car & Foundry Co. Mr. Gabrielson formerly was in the miscellaneous products division of the sales department at New York.

◆

CHICAGO RAILWAY EQUIPMENT COMPANY.—*J. M. Brophy* has been appointed assistant manager of sales, a newly created position, for the Chicago Railway Equipment Company, Chicago.

◆

CLIMAX-MOLYBDENUM COMPANY.—*Richard H. Marshall*, formerly production metallurgist of the Timken Roller Bearing Company, has joined the metallurgical staff of the Climax Molybdenum Company at Chicago.

◆

INTERNATIONAL STEEL COMPANY.—*Henry Bohnsack*, president of the International Steel Company, Evansville, Ind., has been elected chairman of the firm's board. *Walter G. Koch*, senior vice-president and in charge of International's railway division, has become president and chief executive officer. *Wesley D. Hamilton*, vice-president and also in charge of the railway division, has been elected vice-president and director of sales.

◆

YOUNGSTOWN SHEET & TUBE CO.—*D. L. Markle, Jr.*, has been appointed district sales manager in charge of the New Orleans, La., office of the Youngstown Sheet & Tube Co., succeeding the late Orville B. Ewing. Mr. Markle has been associated with the company for almost 11 years.

◆

INDEPENDENT PNEUMATIC TOOL COMPANY.—*Eugene C. O'Connell*, formerly service engineer in the Los Angeles, Calif., branch of the Independent Pneumatic Tool Company, Aurora, Ill., has been appointed manager at San Francisco, Calif., and *Clarence H. Gabriel*, formerly service engineer at the Salt Lake City, Utah, branch, has been appointed manager at Denver, Colo.

◆

AMERICAN BRAKE SHOE COMPANY.—The American Manganese Steel Division of the *American Brake Shoe Company* has appointed the *Whitehead Metal Products Company* distributors of its complete line of Amsco welding products. The Whitehead company operates warehouses in New York, New Jersey, Pennsylvania, Massachusetts and Maryland.

William J. Grant has been appointed manager southern sales for the National Bearing Division of American Brake Shoe, with headquarters in the Southern

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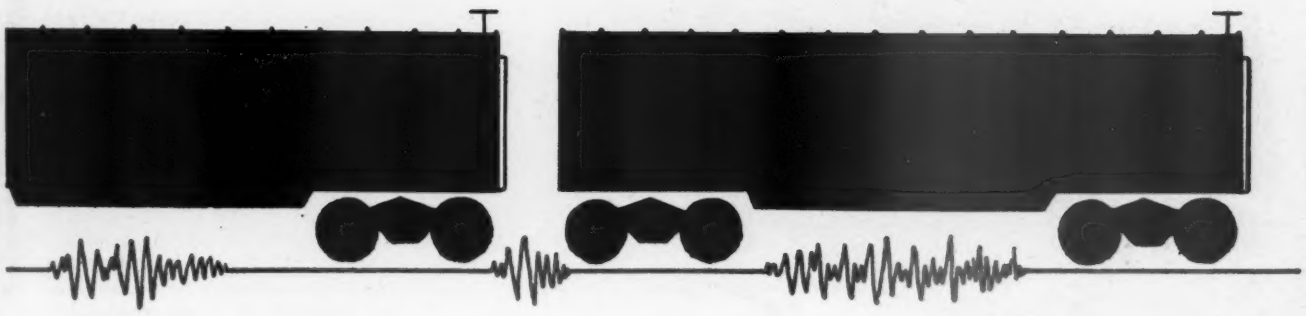

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States building, Richmond, Va. Mr. Grant was formerly sales representative for the company's Brake Shoe and Castings and Southern Wheel divisions.

Robert H. Elem has been appointed Pacific Coast manager of the Welding Products Department of American Brake Shoe.

◆

KOPPERS COMPANY.—The following changes have been made in the production and research departments of the Koppers Company: *Fred Denig*, vice-president, appointed manager of the production department, succeeding *Hugh C. Minton*, who has resigned because of ill health; *G. Frank D'Alelio* appointed vice-president and manager of the research department, the position formerly held by Mr. Denig, and *A. R. Powell*, formerly assistant manager of the research department, appointed associate manager of that department.

◆

MONROE AUTO EQUIPMENT COMPANY.—The following agencies have been established to facilitate repair service on Monroe railroad shock absorbers: the *Durham Company*, New York; *Illinois Auto Electric Company*, Chicago; *Tri-State Distributing Corporation*, Cincinnati, Ohio; *Electric Power Maintenance Company*, Cleveland, Ohio; *Knorr-Maynard, Inc.*, Tampa, Fla.; *Battery & Starter Co.*, Buffalo, N. Y.; *Service Sales of Pittsburgh*, Pa.; *Roberts Brothers Company*, Washington, D. C., and *Motor Ignition Company*, Philadelphia, Pa.

Obituary

CHARLES EDWARD BROWN, JR., vice-president and general sales manager of the Okonite Company, died on November 8. Mr. Brown was 55 years old.

Speeds
LOGGED
Accurately . . . Dependably
Over Hundreds of Thousands of Miles

Like the Diesel locomotive itself, VALVE PILOT DIESEL SPEED RECORDERS roll up huge mileage totals in uninterrupted service. In all sections of the country—on every make of road Diesel—these instruments are recording speeds with typical Valve Pilot precision and durability. Repeated calibration checks and service reports reveal their unfailing, lasting accuracy.

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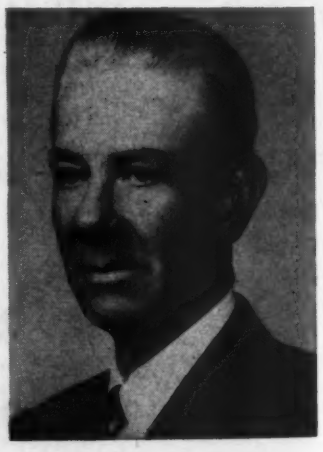
PERSONAL MENTION

General

ARTHUR C. GREENSETH has been appointed general mechanical superintendent of the Duluth, South Shore & Atlantic which has recently been formed to consolidate and take over the properties of the Duluth, South Shore & Atlantic and the Mineral Range.

F. R. HOSACK, mechanical assistant to vice-president—operation of the Chicago, Rock Island & Pacific at Chicago, has been appointed general superintendent of motive power at Chicago. Mr. Hosack was born at Cumberland, Md., on March 3, 1899. He began his railroad career in 1915 as an apprentice machinist with the Southern Pacific at Ennis, Tex. Following service with the armed forces in World War I, he joined the Atchison, Topeka & Santa Fe as a machinist at Temple, Tex. From 1920 to 1930, he was employed by the International-Great



F. R. Hosack

Northern at various points as mechanical foreman, enginehouse foreman and general foreman, subsequently becoming general foreman and later master mechanic of the St. Louis, Brownsville & Mexico at Kingsville, Tex. He was appointed mechanical superintendent, Western district, of the Missouri Pacific at St. Louis, Mo., in 1937. During World War II, Mr. Hosack was a colonel in the Military Railway Service, U. S. Army, serving in the European theater

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Easily Replaced if ways are damaged

You can't wear out Lodge & Shipley hardened ways, but if they're accidentally damaged, you can replace them, avoiding a several thousand dollar bill for lathe rebuilding!

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Your LODGE & SHIPLEY *Engineer* will gladly give you a more detailed explanation *and* demonstration. Call him or write for detailed literature which shows outstanding Profit Features.

of operations. He returned to the M. P. in January, 1946, as assistant chief mechanical officer at St. Louis. He became mechanical assistant to vice-president—operations of the C., R. I. & P. this past September.

C. W. WHISTLER, JR., superintendent of the Logansport division of the Pennsylvania, at Logansport, Ind., has been appointed superintendent of motive power of the Eastern Ohio division, with headquarters at Pittsburgh, Pa. Mr. Whistler was born at Ellwood City, Pa., and entered railroad service in 1923. Following service as master mechanic and superintendent of motive power, he became superintendent of the Logansport division in 1948.

GRANT H. ARRASMITH has been appointed mechanical inspector for the Chicago, Burlington & Quincy at Chicago.

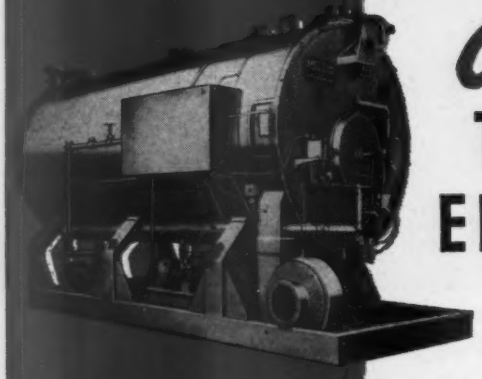
A. H. OSTBERG, mechanical inspector of the Chicago, Burlington & Quincy at Chicago, has retired after 44 years.

J. S. BELL, superintendent of motive power of the Eastern Ohio division of the Pennsylvania at Pittsburgh, Pa., has been transferred to the Eastern Pennsylvania division at Harrisburg, Pa.

AMESTEAM GENERATOR

"The Railroad Boiler"

PRODUCT OF AMES IRON WORKS, OSWEGO, N. Y.



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Abolishes boiler room labor
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Trouble-free, 100% automatic in operation, the AMESTEAM GENERATOR requires no chimney draft, only a simple vent to the atmosphere. Here is compact steam efficiency at its best. This unit takes up only one-third the space required by the conventional boiler. Important savings include elimination of boiler room labor and the fuel-saving advantages of a thermal efficiency of over 80%.

Ideal for low-pressure heat in station or shop, also for high pressure work for sand drying, Diesel de-icing and a host of other railroad applications.

Single units from 10 to 400 H.P. Suitable for multiple installations. Design pressure —15 to 200 lbs. Higher pressures on order.

See what this modern boiler can do for you. *Phone, write or wire.*

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Electrical

L. F. WILLIAMS, assistant electrical engineer of the Southern Pacific Lines at San Francisco, Calif., has been promoted to electrical engineer at San Francisco.

PAUL LEBENBAUM, electrical engineer of the Southern Pacific at San Francisco, Calif., retired recently.

G. W. KAHLER, electrical inspector of the Southern Pacific, has been appointed assistant electrical engineer at San Francisco, Calif.

Car Department

STEPHEN NAGY, assistant foreman, Pittsburgh (Pa.) car yard, Pennsylvania, has been appointed foreman at that yard.

R. B. DULANEY, assistant to foreman car department of the Atlantic Coast Line, has been appointed assistant superintendent car department, at Wilmington, N. C.

E. S. HASSLER, foreman, Pittsburgh (Pa.) card yard, Pennsylvania, has been appointed foreman, steel car shop, Pittsburgh Division, with headquarters at Pitcairn, Pa.

G. H. REA, foreman steel car shop, Pittsburgh Division of the Pennsylvania at Pitcairn, Pa., has been appointed foreman No. 1 yard, Pittsburgh Division.

B. M. HARTER, foreman No. 1 Yard, Pittsburgh Division of the Pennsylvania at Pitcairn, Pa., has been appointed foreman No. 4 Yard, Pittsburgh Division.

Master Mechanics And Road Foremen

BERT BUSH, road foreman of engines of the Chicago & Eastern Illinois, has retired after 48 years of service with that road.

FRED R. BUTTS, master mechanic of the Hannibal-Centerville divisions of the Chicago, Burlington & Quincy at Hannibal, Mo., has retired.

LLOYD G. HARVILLE, assistant master mechanic of the Galesburg (Ill.) and Ottumwa-Creston (Iowa) divisions of the Chicago, Burlington & Quincy, has been appointed master mechanic of the Hannibal-Centerville divisions, with headquarters at Hannibal, Mo.

W. V. AMIG, assistant master mechanic of the Eastern division of the Pennsylvania, has been appointed master mechanic of that division, with headquarters at Pittsburgh, Pa.

JAMES R. VAN NORTWICK, general foreman of locomotive repairs of the Chicago, Burlington & Quincy at Galesburg, Ill., has been appointed assistant master mechanic of the Galesburg (Ill.) and Ottumwa-Creston (Iowa) divisions.

G. R. WEAVER, master mechanic of the Eastern division of the Pennsylvania at Pittsburgh, Pa., has been transferred to the Maryland and Delmarva divisions.

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Printed copies of this talk, in which these three points are very interestingly developed, may be obtained, for the asking, from the Associated Business Publications, 205 East 42nd Street, New York 17, N. Y.

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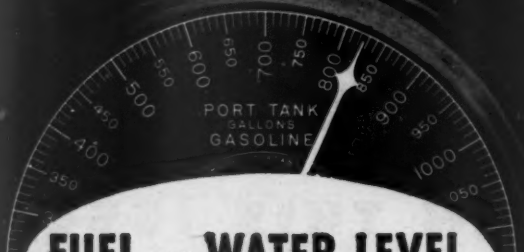

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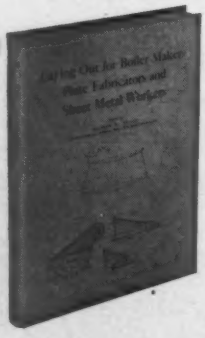
LAYING OUT FOR BOILER MAKERS

By GEORGE M. DAVIES
Assistant Engineer of Motive Power, New York Central



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Reduce lost locomotive time caused by fatigue failures and short gear life!

CAPITOL GEARS are used by many leading railroads of the nation. Engineered design . . . high quality materials . . . precision cutting . . . correct heat treatment plus "know how" of over 42 years of gear manufacturing experience assures you of longer service under the most severe operating conditions. Let us make your next gears!

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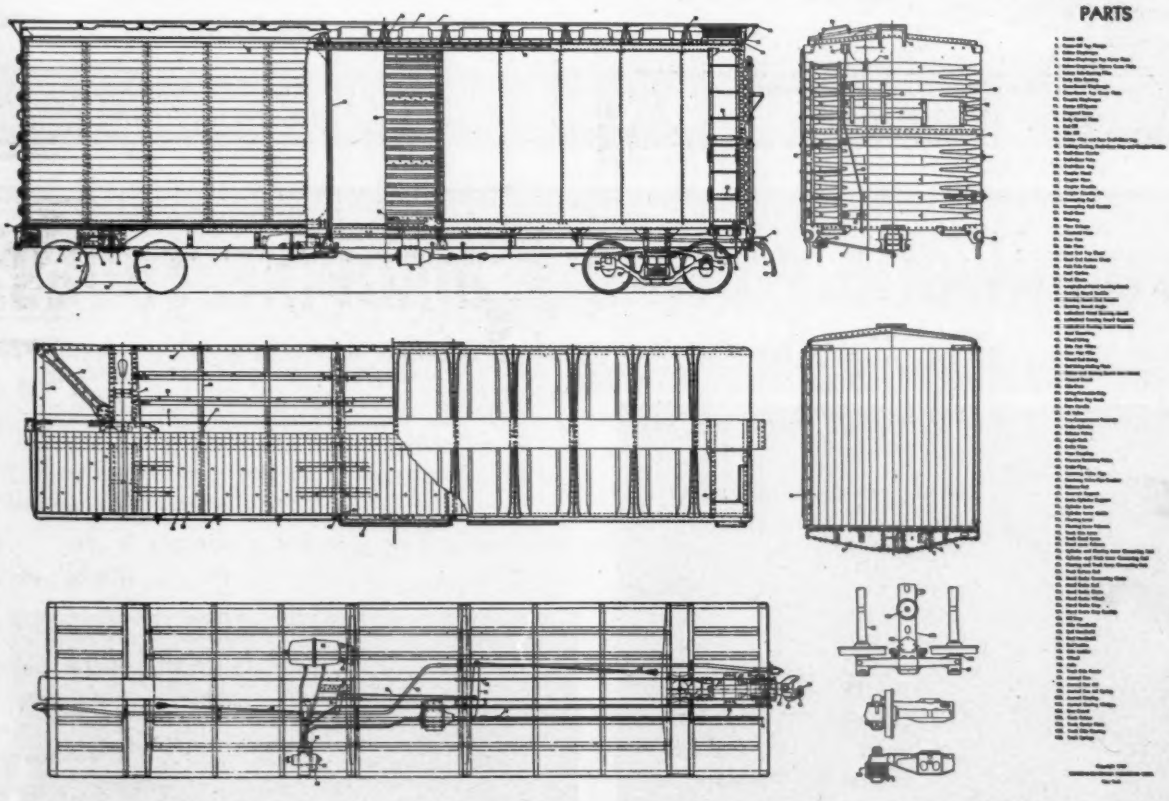

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Railroad Division **EX-CELL-O CORPORATION** *Detroit 6, Michigan*

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For Railway Shops and Engine Houses

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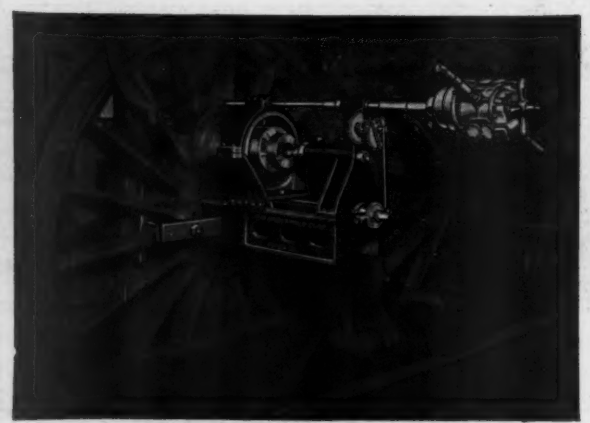

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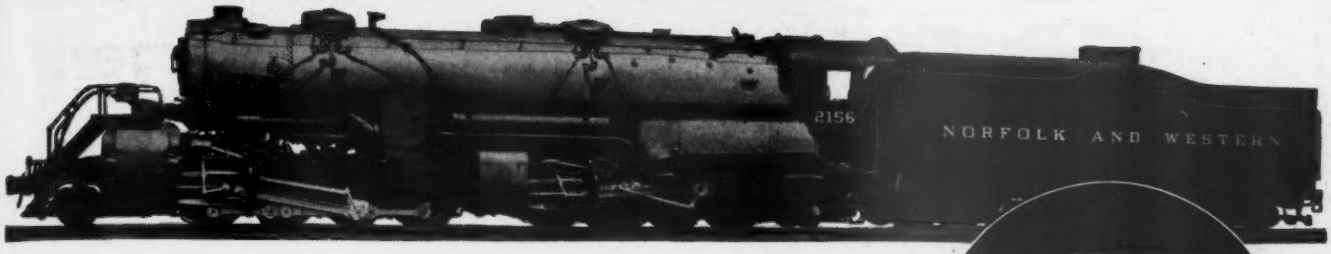

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Ten new NORFOLK & WESTERN 2-8-8-2 Class Y-6B Mallets take the track . . . each equipped with BAKER VALVE GEARS for greatly improved starting, plus high speeds on less fuel and water! Working right along with the Pilliod Company's famous, alloy-steel-improved BAKER VALVE GEARS are McGILL **MULTIROL BEARINGS, with two rows of small diameter rollers,** thrust washers to take up lateral wear, through-hardened raceways, and design that makes it possible to lubricate with either grease or oil. BAKER VALVE GEARS, equipped with McGILL MULTIROL BEARINGS — a winning team for power-performance and real economy every trip!

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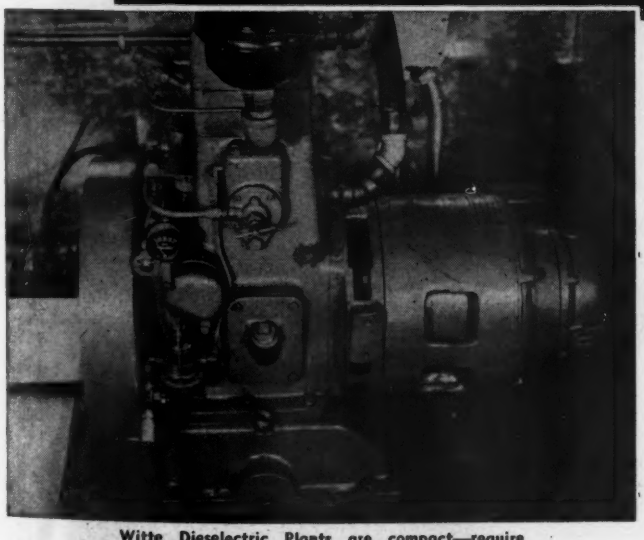
Speed up Freight Movements with Diesel-Powered Radio Communications



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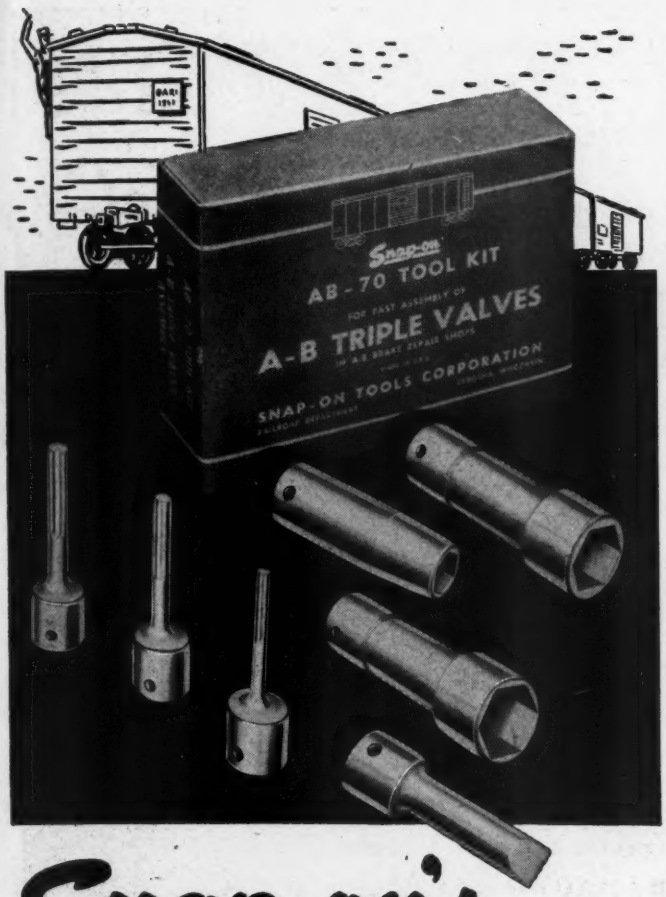
RUNNING BOARDS, BRAKE STEPS, AND PLATFORMS
FOR TANK CARS



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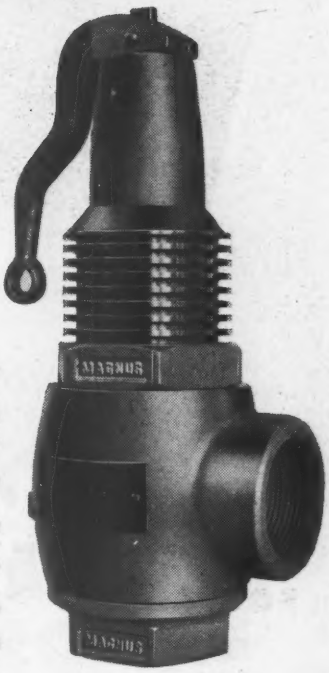
MAGNUS TYPE "IV" DIESEL STEAM GENERATOR SAFETY VALVE



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OLD-TIMERS don't have to guess when the call is out for the *best* in boiler tubes. They know from experience that when it comes to dependability, easy installation and long-time service there's nothing that fills the bill quite so well as NATIONAL Seamless.

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That's because in these famous "Walls without Welds," there's no weld—no line of potential weakness. The unique piercing process, pioneered by NATIONAL, offers positive assurance of uniform wall strength, provides the structural homogeneity and the assured safety, security, and dependability of a solid forging.

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Remember, whether it's for new construction or for repairs, there's only one way to do a good job—use the *best* tubes you can buy. NATIONAL Seamless is the name.

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RESEARCH OF America's largest petroleum laboratories — where a staff of over 2000 scientists and technicians *make sure* Esso Diesel is always a fine, high-quality diesel fuel.

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